



## **STEP 3 – PROBLEM FORMULATION REPORT FOR THE BASELINE ECOLOGICAL RISK ASSESSMENT**

**DEVIL’S SWAMP LAKE SITE  
EAST BATON ROUGE PARISH, LOUISIANA  
AGENCY INTEREST (AI) NO. 86800  
EPA ID LAD981155872, SSID #06N1  
CERCLA DOCKET NO. 06-04-10**

**Prepared For:**

**Baton Rouge Disposal, LLC  
Baton Rouge, Louisiana**

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## **EXECUTIVE SUMMARY**

Step 3 of the United States Environmental Protection Agency's (EPA) 8-step process for conducting ecological risk assessments was completed as reported herein for the Devil's Swamp Lake Site in East Baton Parish, Louisiana. A screening-level ecological risk assessment (SLERA), which consists of Steps 1 and 2 of the 8-step process, was submitted to EPA and the Louisiana Department of Environment Quality (LDEQ) in July 2011 as part of the *Tier 1 Remedial Investigation* (RI) Report. The SLERA was revised in accordance with comments from the EPA and LDEQ and re-submitted in February 2012. The SLERA identified a potential for risk to one or more groups of ecological receptors for each of the four Areas of Investigation (AOIs) at the Site, which prompted the completion of this third step.

The methods and assumptions regarding exposure and toxicity in the SLERA were intentionally conservative in order to avoid incorrectly dismissing a potential for risk at the screening level. This may have resulted in an overestimation of risk for several exposure pathways and receptor groups. In Step 3, the Problem Formulation for the Baseline Ecological Risk Assessment (BERA), the media concentrations and assumptions regarding exposure and toxicity are reviewed and modified, as appropriate, in order to focus the BERA on those pathways and receptors that actually have a potential for risk above the threshold for concern. The refinement process in Step 3 considered alternative ecological benchmarks, measures of central tendency as exposure concentrations, and area use.

Step 3 identified a potential for risk to benthic invertebrates, avian and mammalian insectivores, mammalian herbivores, and avian and mammalian piscivores in one or more of the AOIs. The highest number of exposure pathways and receptors potentially at risk were identified for the Drainage Ditch AOI. Avian and mammalian insectivores exposed to sediment were the only receptors and pathways identified as potentially at risk for the North-Central Devil's Swamp and South Devil's Swamp Lake AOIs. However, due to the relatively high degree of uncertainty in the calculation of constituents of potential ecological concern (COPECs) in fish, avian and mammalian piscivores in all AOIs are also identified as potentially at risk.

The results of the Step 3 Problem Formulation will be used to develop a sampling program for the Tier 2 RI. To facilitate development of the sampling program, risk questions and testable hypotheses and conceptual site models (CSMs) have been developed for each AOI as part of the BERA Problem Formulation.

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## LIST OF ACRONYMS

AOI	Area of Investigation
AUF	Area Use Factor
BCF	Bioconcentration Factor
BERA	Baseline Ecological Risk Assessment
BSAF	Biota-to-Sediment Accumulation Factor
BW	Body Weight
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPEC	Constituent of Potential Ecological Concern
CSM	Conceptual Site Model
DW	Dry Weight
EC <sub>20</sub>	20 % Effects Concentration
EC <sub>25</sub>	25 % Effects Concentration
EPA	U. S. Environmental Protection Agency
ESV	Ecological Screening Value
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IR	Ingestion Rate
kg	Kilogram
L	Liter
LCV	Lowest Chronic Value
LDEQ	Louisiana Department of Environmental Quality
LOAEL	Lowest Observed Adverse Effects Level
LOD	Limit of Detection
mg	Milligram
NOAEL	No Observed Adverse Effects Level
OC	Organic Carbon
PCB	Polychlorinated Biphenyl
PEC	Probable Effects Concentration
QAPP	Quality Assurance Project Plan
RB	Refinement Benchmark
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SLERA	Screening-Level Ecological Risk Assessment
SOW	Scope of Work
TEC	Threshold Effects Concentration
TEF	Toxicity Equivalence Factor



TRV	Toxicity Reference Value
UAO	Unilateral Administrative Order
UCL	Upper Confidence Limit
µg/L	Micrograms/Liter
WW	Wet Weight

## 1.0 INTRODUCTION

Clean Harbors Environmental Services, Inc. (Clean Harbors), on behalf of Baton Rouge Disposal, LLC, hereby submits to the United States Environmental Protection Agency (EPA) the Step 3- Problem Formulation Report for the Baseline Ecological Risk Assessment (BERA) for the Devil's Swamp Lake Site (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. 06-04-10) located near Baton Rouge, Louisiana (Site). The Site consists of a man-made crescent-shaped lake and associated wetlands located on the Mississippi River east bank floodplain approximately ten miles north of Baton Rouge, Louisiana. The Site location is shown on the vicinity map included as Figure 1-1.

This Report was prepared in accordance with the requirements outlined in the Unilateral Administrative Order (UAO) for Remedial Investigation/Feasibility Study (RI/FS) for the Devil's Swamp Lake Site issued on December 3, 2009. The UAO was issued to Baton Rouge Disposal, LLC, by EPA Region 6 and became effective on December 18, 2009. In accordance with the general requirements of the UAO scope of work (SOW), the RI/FS will include the investigation and evaluation of the horizontal and vertical extent of impact and feasible remedies for polychlorinated biphenyl (PCB) impact in the lake and adjoining portions of the swamp (UAO, Appendix A, Section 1.0.3.3).

The *Draft Tier 1 RI Work Plan* was submitted on July 23, 2010. The EPA and the Louisiana Department of Environmental Quality (LDEQ) submitted review comments on the *Draft Tier 1 RI Work Plan* on September 1, 2010, and October 1, 2010, and Clean Harbors submitted tables summarizing the review comment responses on September 17, 2010, and November 4, 2010, respectively. In addition, the EPA provided review comments on the Quality Assurance Project Plan (QAPP) submitted as Appendix B of the *Draft Tier 1 RI Work Plan* in a correspondence dated August 11, 2010. The correspondence included a review checklist and a request for the QAPP to be submitted as a stand alone document. Clean Harbors requested that submittal of the revised QAPP be contingent on agreement and approval of the *Draft Tier 1 RI Work Plan*. The EPA approved the work plan review comment responses in a correspondence dated November 10, 2010. The approval letter included a request for submittal of the *Final Tier 1 RI Work Plan* and revised QAPP for review and approval. The QAPP was submitted under separate cover on November 24, 2010, and included the requested revisions. The *Final Tier 1 RI Work Plan* (Work Plan) was also submitted on November 24, 2010. The EPA approved the QAPP and *Final Tier 1 RI Work Plan* in a letter dated December 10, 2010. The LDEQ issued comments on the *Draft Tier 1 RI Work Plan* in a letter dated January 7, 2011. The LDEQ acknowledged the *Final Tier 1 RI Work*

*Plan* was approved by the EPA and requested evaluation of the additional LDEQ comments in the Tier 1 RI Report and/or in the scope of work for the Tier 2 RI. Clean Harbors submitted responses to the LDEQ review comments on January 18, 2011.

The Tier 1 RI sample collection activities were completed during the weeks of January 17, 2011, and January 24, 2011. Sediment and surface water samples were collected in accordance with the approved work plan. The *Draft Tier 1 RI Report* was submitted in July 2011 and included a summary of the scope of work completed during the Tier 1 RI sampling activities and the results of the screening level Human Health Risk Assessment (HHRA) and the Screening Level Ecological Risk Assessment (SLERA). On August 23, 2011, the EPA issued review comments on the *Draft Tier 1 RI Report* by email. The email included a transmittal letter and table listing the review comments. The table included comments submitted by the EPA, LDHH, US Fish and Wildlife Service (USFWS), and LDEQ. The submittal also included a table with suggested assessment and measurement endpoints for the Baseline Ecological Risk Assessment (BERA). The *Draft Step 3 - Problem Formulation Report for the Baseline Ecological Risk Assessment* (BERA) was submitted to the EPA on October 14, 2011. The EPA submitted additional review comments for the *Draft Tier 1 RI Report* in a letter dated October 17, 2011. Representatives of the EPA, LDEQ, US Fish and Wildlife Service (USFWS), Louisiana Department of Health and Hospitals (LDHH), EA Engineering, Science, and Technology (EA), Clean Harbors, and Conestoga Rovers & Associates (CRA) participated in a meeting at the LDEQ office on November 9, 2011. The meeting discussion included the responses to the agency review comments on the *Draft Tier 1 RI Report*, the LDEQ fishing advisory, and the agency review comments on the *Step 3 - Problem Formulation Report for the BERA*. The EPA submitted the EPA and USFWS review comments on the *Step 3 - Problem Formulation Report for the BERA* by email on November 15, 2011. On November 28, 2011, the LDEQ submitted review comments on the *Step 3 - Problem Formulation Report for the BERA* via fax and hard copy. On December 20, 2011, Clean Harbors and CRA met with representatives of the LDEQ to discuss the potential scope of work to address the fishing advisory. The LDEQ provided a list of requested tissue sample species, number of samples, constituents of concern for analysis, and areas for sample collection necessary to address the fishing advisory. In addition, Clean Harbors submitted responses to the EPA, LDEQ, and US Fish and Wildlife Service (USFWS) comments on the *Step 3 - Problem Formulation Report for the BERA* to the EPA by email on January 10, 2012. Review comment response tables for the *Step 3 - Problem Formulation Report for the BERA* are included in Appendix A. The EPA *Step 3 - Problem Formulation Report for the BERA* approval letter dated January 31, 2012, is attached in Appendix B.

The SLERA included an evaluation of the potential for risk to ecological receptors exposed to surface water, sediment, and soil within the four Areas of Investigation (AOI) of the Site. The AOI boundaries are shown on Figure 1-2.

The SLERA consisted of Steps 1 and 2 of the EPA 8-step process for conducting ecological risk assessments (USEPA, 1997). Consistent with a screening-level assessment, only the maximum concentrations of PCBs in surface water, sediment, and soil samples collected from the Site were considered. Other assumptions regarding exposure and toxicity were conservative in order to avoid incorrectly dismissing the potential for risk to ecological receptors. The SLERA identified a potential for risk to one or more receptors groups for all four AOIs.

In the SLERA, the maximum concentration of each PCB aroclor detected in surface water, sediment, and soil samples was compared to an ecological screening value (ESV), which was generally the most conservative ecological benchmark. For avian and mammalian receptors, simple food chain models were used to evaluate potential risk to insectivores, herbivores, and piscivores. The food chain models were based on maximum concentrations, No Observed Adverse Effects Levels (NOAELs), and the assumption that all food consumed by receptors was from the areas of maximum concentration. In Step 3, exposure pathways and receptors identified as potentially at risk in the SLERA are refined by considering alternative ecological benchmarks (surface water and benthic invertebrates exposed for sediment) and more realistic estimates of exposure concentrations and area use (avian and mammalian receptors).

## **1.1 OBJECTIVE**

This Problem Formulation Report presents the methods and results of Step 3 of the 8-step process for conducting ecological risk assessment under EPA guidance (USEPA, 1997). Step 3, the Problem Formulation step for the BERA, refines the exposure pathways and receptors potentially at risk by reviewing and modifying the assumptions in the SLERA regarding exposure and toxicity, as appropriate. One of the primary objectives of the Step 3 Problem Formulation is to identify data gaps and focus the development of the Tier 2 RI sampling program on the exposure pathways and receptors for which a potential for ecological risk has been identified or is uncertain.

## 1.2 REPORT ORGANIZATION

This document is organized as follows:

- Section 1.0- Introduction: Presents relevant background information for the Site, the purpose and objectives of this document, and its organization;
- Section 2.0- Summary of SLERA: Provides a summary of the SLERA, including the exposure pathways and receptors identified as potentially being at risk;
- Section 3.0- Refinement Methodology: Describes the methods for refining the exposure pathways and receptors potentially at risk, including selection of refinement benchmarks (RBs);
- Section 4.0- Refinement of Constituents of Potential Ecological Concern: Provides a discussion of the refinement process for surface water, sediment, and soil;
- Section 5.0- Ecosystems at Risk: Discusses ecosystems potentially at risk upon completion of the refinement process;
- Section 6.0- Selection of Assessment Endpoints: Discusses assessment endpoints for the BERA;
- Section 7.0- Conceptual Site Model and Risk Questions: Discusses the conceptual site models (CSMs) and risk questions and testable hypotheses for the BERA;
- Section 8.0- Analysis of Uncertainties: Provides an analysis of uncertainties associated with the refinement and Problem Formulation process;
- Section 9.0- Conclusions: Presents the conclusions of the Step 3 Problem Formulation process; and
- Section 10- References: Identifies literature and references used in Step 3.

## **2.0     SUMMARY OF THE SLERA**

The following sections include a summary of the results of the SLERA completed during the Tier 1 RI.

### **2.1     CONSTITUENTS OF POTENTIAL ECOLOGICAL CONCERN**

The constituents of potential ecological concern (COPECs) identified in the SLERA in each AOI are discussed in the following sections.

#### **2.1.1     NORTH-CENTRAL DEVIL’S SWAMP AOI**

Table 2-1 includes a summary of the media and receptor groups identified in the SLERA as potentially at risk and requiring further evaluation in the North-Central Devil’s Swamp AOI. Sediment is the only medium with concentrations that potentially pose risk to ecological receptors. PCBs were not detected in surface water in the North-Central Devil’s Swamp AOI. Nine of the 15 solid samples collected in this AOI were evaluated as soil. The potential for risk to soil invertebrates, terrestrial plants, and wildlife was identified in the SLERA as below the threshold for concern.

Receptor groups identified as potentially at risk in the North-Central Devil’s Swamp AOI are benthic invertebrates, avian and mammalian insectivores, and avian and mammalian piscivores. The SLERA evaluated risk to avian and mammalian herbivores using food chain models. The potential for risk to these receptor groups was determined to be below the threshold for concern.

As identified in Table 2-1, risk was evaluated for both PCB aroclors and congeners. For the PCB congeners, a potential for risk was identified for avian and mammalian insectivores and avian and mammalian piscivores.

#### **2.1.2     DRAINAGE DITCH AOI**

Table 2-2 includes a summary of the media and receptor groups identified as potentially at risk in the Drainage Ditch AOI. For surface water, the SLERA identified a potential for risk to fish and aquatic plants. For soil, a potential for risk was identified for wildlife. Because a generic benchmark was used for soil, the receptors groups potentially at risk (e.g., insectivores, herbivores, and carnivores) were not identified.

For sediment, the SLERA identified a potential for risk to benthic invertebrates, avian and mammalian insectivores, and avian and mammalian piscivores. For aroclors and congeners, the food chain models in the SLERA identified a potential for risk to avian and mammalian herbivores below the threshold for concern. Three of the 12 sediment samples collected from the Drainage Ditch AOI were analyzed for PCB congeners. The sample with the highest concentration of total PCBs was not analyzed for congeners. Therefore, the potential risk for avian and mammalian receptors from exposure to PCB congeners is uncertain.

### **2.1.3      NORTH DEVIL'S SWAMP LAKE AOI**

Table 2-3 includes a summary of the media and receptor groups identified as potentially at risk in the North Devil's Swamp Lake AOI. Sediment is the only medium with concentrations that potentially pose risk to ecological receptors. Aroclor 1016 was the only aroclor detected in surface water and it was detected in only one of the 15 surface water samples collected from the North Devil's Swamp Lake AOI. The single detected concentration of Aroclor 1016 was below the ESV for aquatic invertebrates, fish, and aquatic plants. None of the solid samples collected in this AOI were determined to be soil.

For sediment, receptor groups identified as potentially at risk in the North Devil's Swamp Lake AOI are benthic invertebrates, avian and mammalian insectivores, mammalian herbivores, and avian and mammalian piscivores. The SLERA evaluated risk to avian herbivores using food chain models. The potential for risk to this receptor group was determined to be below the threshold for concern for both aroclors and congeners.

Four of the 15 sediment samples from the North Devil's Swamp Lake AOI were analyzed for PCB congeners. The sample with the highest concentration of total PCBs was not analyzed for congeners. Therefore, the potential risk for avian and mammalian receptors from exposure to PCB congeners is uncertain. Similarly, the food chain models for mammalian herbivores exposed to PCB congeners did not identify a potential for risk above the threshold for concern. Because the sample with the highest concentration of total PCBs was not analyzed for congeners, the potential for risk to mammalian herbivores and avian piscivores is uncertain.

## **2.1.4      SOUTH DEVIL'S SWAMP LAKE AOI**

Table 2-4 includes a summary of the media and receptor groups identified as potentially at risk in the South Devil's Swamp Lake AOI. Sediment is the only medium with concentrations that potentially pose risk to ecological receptors. PCBs were not detected in surface water in the South Devil's Swamp Lake AOI. None of the ten solid samples collected in this AOI were determined to be soil.

For sediment, receptor groups identified as potentially at risk in the South Devil's Swamp Lake AOI include benthic invertebrates, avian and mammalian insectivores, and avian and mammalian piscivores. The SLERA evaluated risk to avian and mammalian herbivores using food chain models. The potential for risk to these receptor groups was determined to be below the threshold for concern for both aroclors and congeners.

Three of the ten sediment samples in the South Devil's Swamp Lake AOI were analyzed for PCB congeners. Avian and mammalian insectivores and piscivores were identified as potentially at risk. The food chain models for avian and mammalian herbivores exposed to PCB congeners did not identify a potential for risk above the threshold for concern. Because the sample with the highest concentration of total PCBs was not analyzed for congeners, the potential for risk to mammalian and avian receptors is uncertain.

## **2.2      ASSESSMENT ENDPOINTS**

The assessment endpoints identified in the SLERA include the following:

### ***Surface Water***

- Survival, growth and reproduction of aquatic invertebrates, aquatic plants, and fish
- Growth and reproduction of avian and mammalian piscivores

### ***Sediment***

- Survival, growth and reproduction of benthic invertebrates and aquatic plants
- Growth and reproduction of avian and mammalian insectivores
- Growth and reproduction of avian and mammalian herbivores
- Growth and reproduction of avian and mammalian piscivores



### *Soil*

- Survival, growth and reproduction of soil invertebrates and terrestrial plants
- Growth and reproduction of avian and mammalian insectivores
- Growth and reproduction of avian and mammalian herbivores
- Growth and reproduction of avian and mammalian carnivores

The assessment endpoints identified in the SLERA are also used for the refinement of COPECs in Step 3.

### 3.0 REFINEMENT METHODOLOGY

The following sections include a discussion of the refinement methodology used to evaluate the ecological benchmarks and exposure concentrations used in the SLERA. Appendix C provides the summary statistics and exposure concentrations for surface water, sediment, and soil for each AOI.

#### 3.1 SURFACE WATER

##### Refinement Benchmarks

The maximum concentration in the surface water in the Drainage Ditch AOI exceeded the ecological benchmarks for fish and aquatic plants. In the North-Central Devil's Swamp AOI, North Devil's Swamp Lake AOI, and South Devil's Swamp Lake AOI, PCBs were either not detected or, if detected, have concentrations below the ESVs for aquatic invertebrates, fish, and aquatic plants. Aroclor 1254 was detected in ten of the twelve surface water samples collected from the Drainage Ditch AOI and Aroclor 1260 was detected in one sample. Ecological benchmarks are not available for the individual aroclors. Therefore, the benchmarks considered in the refinement process are for total aroclors. Surface water samples were not analyzed for PCB congeners.

The ESV for fish exposed to surface water was the lowest chronic value (LCV) of 0.2 micrograms per liter ( $\mu\text{g/L}$ ) identified by Suter and Tsao (1996). This value is the lowest of the three benchmarks for fish identified by Suter and Tsao (1996). The other ecological benchmarks for fish are a 20% effects concentration ( $\text{EC}_{20}$ ) of 0.4  $\mu\text{g/L}$  and a 25% effects concentration ( $\text{EC}_{25}$ ) for bass of 0.63  $\mu\text{g/L}$ . The geometric mean of these three benchmarks, 0.369  $\mu\text{g/L}$ , is selected as the RB.

The ESV for aquatic plants exposed to surface water was the LCV of 0.144  $\mu\text{g/L}$  identified by Suter and Tsao (1996). No other ecological benchmarks specific to aquatic plants was identified. Therefore, the ESV of 0.144  $\mu\text{g/L}$  is the RB for aquatic plants.

##### Exposure Concentrations

In the SLERA, the maximum concentration for total aroclors was compared to the ESV. For the refinement process, several statistics are considered as exposure concentrations including the 95 percent upper confidence limit (UCL), arithmetic mean, median, and geometric mean. Statistics other than the 95 percent UCL are considered as relevant given the relatively small sample size, which leads to excessive variance estimates and produces a 95 percent UCL that is similar to the maximum concentration.

## 3.2 SEDIMENT

### 3.2.1 BENTHIC INVERTEBRATES

#### Refinement Benchmarks

The SLERA identified a potential for risk to benthic invertebrates for all four AOIs. The ESV for benthic invertebrates was the consensus threshold effects concentration (TEC) of 59.8 micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ) identified by MacDonald et al. (2000). This benchmark represents a concentration below which ecologically significant impacts to benthic invertebrates are not expected to occur. MacDonald et al. (2000) also identifies a probable effects concentration (PEC) of 676  $\mu\text{g}/\text{kg}$ , above which ecologically significant impacts to benthic invertebrates are expected to be expressed. The TEC and PEC define lower and upper bounds for expected ecologically significant impacts. The midpoint of the TEC and PEC, 368  $\mu\text{g}/\text{kg}$ , is selected as the RB for benthic invertebrates.

#### Exposure Concentrations

Benthic invertebrates have limited mobility. Therefore, statistics of central tendency, such as the 95 percent UCL, arithmetic mean, median, and geometric mean, have limited value in assessing the potential for risk to benthic invertebrates. For the refinement process, concentrations of total aroclors in the individual sediment samples are compared to the RB of 368  $\mu\text{g}/\text{kg}$ . The percentage of samples within each AOI that exceed the RB is also identified.

### 3.2.2 AVIAN AND MAMMALIAN RECEPTORS

#### Refinement Benchmarks

For those receptors evaluated using food chain models, the SLERA considered only the NOAEL, which represents an ingestion rate (IR), expressed as milligrams (mg) of COPEC ingested per kilogram (kg) of body weight (BW) per day, below which ecologically significant effects (i.e., growth, reproduction, and/or survival) are not expected to be expressed. For the refinement process, lowest observed adverse effects levels (LOAELs) are also considered. A LOAEL represents the lowest IR at which ecologically significant effects are expected to be expressed. Table 3-1 and Table 3-2 identify the NOAELs and LOAELs for the avian and mammalian indicator species, respectively, evaluated in the refinement process. Section 3.4 provides a discussion of the indicator species.

Sample et al. (1996) is the source of the LOAELs and NOAELs identified in Table 3-1 and Table 3-2. The source document does not identify NOAELs and LOAELs for all aroclors. For those aroclors that do not have a NOAEL and/or LOAEL identified by Sample et al. (1996), the lowest of the available aroclor-specific NOAELs or LOAELs is assigned as the toxicity reference value (TRV).

Sample et al. (1996) does not identify NOAELs or LOAELs for muskrat or a deer mouse. The NOAELs and LOAELs for these two indicator species were derived using the following equation, which is based on allometric scaling:

$$TRV_{\text{Indicator Species}} = TRV_{\text{Test Species}} * [BW_{\text{Test Species}} / BW_{\text{Indicator Species}}]^{(1-b)} \quad (\text{Eq 1})$$

Where:

- $TRV_{\text{Test Species}}$  = the toxicity reference value for the test organism,
- $BW_{\text{Test Species}}$  = the body weight of the test organism as identified in Sample et al. (1996),
- $BW_{\text{Indicator Species}}$  = the body weight of the indicator species, and
- $b$  = the allometric scaling factor for mammals (0.94).

### Exposure Concentrations

The exposure concentrations for avian and mammalian receptors in the SLERA were the maximum concentrations of the individual aroclors and PCB congeners. For aroclors and congeners that were not detected, the maximum limit of detection (LOD) was used as the exposure concentration. For the refinement process, measures of central tendency are used as exposure concentrations. If sufficient data were available, the 95 percent UCL was calculated using ProUCL (USEPA, 2007). If sufficient data used to calculate a 95 percent UCL were not available, or the calculated UCL exceeded the maximum concentration, then the larger of the arithmetic mean and median concentration was used as the exposure concentration. For those aroclors and congeners that were not detected within an AOI, the midpoint of the lowest and highest LOD was used as the exposure concentration.

For aroclors in sediment, the 95 percent UCL, or the higher of the arithmetic means and medians concentration was used as the exposure concentration for the individual aroclors for incidental ingestion of sediment and to calculate concentrations in benthic invertebrates, aquatic plants, and fish ingestion by avian and mammalian receptors. Due to the small number of samples, 95 percent UCLs were not calculated for PCB

congeners. Therefore, the higher of the arithmetic mean and median concentrations was considered. The methods for calculating concentration of the individual aroclors and congeners in benthic invertebrates, aquatic plants, and fish were the same as those used in the SLERA.

Concentrations of aroclors and congeners in benthic invertebrates consumed by avian and mammalian insectivores were calculated using Equation 2, which is based on empirical results of Tracey and Hansen (1996). Tracey and Hansen (1996) present empirical biota-to-sediment accumulation factors (BSAFs) normalized to organic carbon (OC) in sediment and lipid in benthic invertebrates.

$$\text{Conc}_{\text{invertebrate}} = \text{BSAF} * (\text{Conc}_{\text{sediment}} / \text{OC}) \text{Lipid}_{\text{invertebrate}} \quad (\text{Eq. 2})$$

Where:

$\text{Conc}_{\text{invertebrate}}$  = concentration in invertebrates (mg (wet weight [WW])/kg)

$\text{BSAF}$  = 1.1 (unitless)

$\text{Conc}_{\text{sediment}}$  = 95 percent UCL or mean/median concentration in sediment (mg (dry weight [DW])/kg)

$\text{OC}$  = organic carbon (percent/100)

$\text{Lipid}_{\text{invertebrate}}$  = lipid content of invertebrates (percent/100)

The median BSAF for aroclors and congeners is 1.1 on a gram lipid per gram OC basis. The mean of the samples from each AOI was used as the OC value. The mean OC values for the four AOIs are:

North-Central Devil's Swamp AOI	0.018
Drainage Ditch AOI	0.0018
North Devil's Swamp Lake AOI	0.011
South Devil's Swamp Lake AOI	0.016

Aquatic invertebrates were assumed to have lipid levels of 2 percent (Oliver and Niimi, 1988). For the PCB congeners, exposure concentrations were adjusted using the toxicity equivalence factors (TEF) identified by USEPA (2008). The calculated concentrations of the individual aroclors and congeners in benthic invertebrates for the four AOIs are identified in Table 3-3 through Table 3-14.

Concentrations of PCBs in plant material consumed by avian and mammalian herbivores were calculated using the sediment-to-plant bioconcentration factor (BCF) of 0.01 recommended by USEPA (1999a). This calculation is provided as Equation 3:

$$\text{Conc}_{\text{plant}} = \text{BCF} * \text{Conc}_{\text{sediment}} \quad (\text{Eq. 3})$$

Where:

$\text{Conc}_{\text{plant}}$  = concentration in plant material (mg (WW)/kg)

BCF = 0.01 (unitless)

$\text{Conc}_{\text{sediment}}$  = 95 percent UCL or mean/median concentration in sediment (mg (DW)/kg)

For the PCB congeners, exposure concentrations were adjusted using the TEFs identified by USEPA (2008). The calculated concentrations of the individual aroclors and congeners in aquatic plants for the four AOIs are identified in Table 3-3 through Table 3-14.

Concentrations of the individual aroclors and congeners in fish consumed by avian and mammalian piscivores were calculated using Equation 4, which is similar to Equation 2, and is based on empirical results of Tracey and Hansen (1996).

$$\text{Conc}_{\text{fish}} = \text{BSAF} * (\text{Conc}_{\text{sediment}} / \text{OC}) \text{Lipid}_{\text{fish}} \quad (\text{Eq. 4})$$

Where:

$\text{Conc}_{\text{fish}}$  = concentration in fish (mg (WW)/kg)

BSAF = 1.1 for aroclors, congener-specific (unitless)

$\text{Conc}_{\text{sediment}}$  = 95 percent UCL or mean/median concentration in sediment (mg (DW)/kg)

OC = organic carbon (percent/100)

$\text{Lipid}_{\text{fish}}$  = lipid content of fish (percent/100)

The BSAF for aroclors is 1.1 on a gram lipid per gram OC basis. The BSAFs for congeners are specific to each congener. For OC, the mean of the samples from each AOI, as identified above, was used. Fish were assumed to have lipid levels of 6 percent (USEPA, 1995). For the PCB congeners, exposure concentrations were adjusted using the TEFs identified by USEPA (2008). The calculated concentrations of the individual

aroclors and congeners in fish for the four AOIs are identified in Table 3-3 through Table 3-14.

### 3.3 SOIL

#### Refinement Benchmarks

Several samples collected from the North-Central Devil's Swamp AOI and the Drainage Ditch AOI were evaluated as soil. The SLERA identified a potential for risk to wildlife exposed to soil in the Drainage Ditch AOI. The SLERA considered only the maximum detected concentrations. Similar to sediment, the refinement process considers measures of central tendency as exposure concentrations for soil. The SLERA evaluated risk to avian and mammalian receptors using an ecological benchmark for wildlife (0.65 mg/kg as identified by the Washington State Department of Ecology). For the refinement process, risk to avian and mammalian receptors exposed to soil in the Drainage Ditch AOI is evaluated using food chain models.

#### Exposure Concentrations

For aroclors in soil, the 95 percent UCL, or the higher of the arithmetic mean and median concentration was used as the exposure concentration for the individual aroclors for incidental ingestion of soil and to calculate concentrations in soil invertebrates, terrestrial plants, and small mammals ingested by avian and mammalian receptors. Due to the small number of samples, 95 percent UCLs could not be calculated for PCB congeners. Therefore, the higher of the arithmetic mean and median concentrations was considered. For those aroclors and congeners that were not detected within an AOI, the midpoint of the lowest and highest LOD was considered.

Concentrations of aroclors and congeners in soil invertebrates consumed by avian and mammalian insectivores were calculated using Equation 5.

$$\text{Conc}_{\text{soil invertebrate}} = \text{BCF} * \text{Conc}_{\text{soil}} \quad (\text{Eq. 5})$$

Where:

$\text{Conc}_{\text{soil invertebrate}}$	=	concentration in soil invertebrates (mg (WW)/kg)
BCF	=	1.13 (unitless)
$\text{Conc}_{\text{soil}}$	=	95 percent UCL or mean/median concentration in soil (mg (DW)/kg)

Concentrations of aroclors and congeners in terrestrial plants were calculated using Equation 2. Concentrations in small mammals consumed by avian and mammalian receptors were assumed to be equal to concentrations in soil invertebrates. For the PCB congeners, exposure concentrations were adjusted using the TEFs identified by USEPA (2008).

As discussed in the following section, the refinement process considers ingestion of food from both aquatic and terrestrial habitats. For upper trophic level receptors, this includes ingestion of prey exposed to both sediment and soil. Soil was identified as an exposure medium only for the North-Central Devil's Swamp AOI and Drainage Ditch AOI. Exposure concentrations for these two AOIs are based on soil from the AOI. For the North Devil's Swamp Lake AOI and South Devil's Swamp Lake AOI, the exposure concentrations are based on the combined data for the North-Central Devil's Swamp Lake AOI and Drainage Ditch AOI.

Exposure concentrations for soil, soil invertebrates, terrestrial plants, and small mammals for the four AOIs are identified in Tables 3-3 and 3-4.

### 3.4 FOOD CHAIN MODELS

#### Indicator Species

In the SLERA, the indicator species for avian receptors included the green heron, Canada goose, belted kingfisher, and bald eagle. The indicator species for mammalian receptors included the little brown bat, muskrat, and mink. The green heron, belted kingfisher, bald eagle, little brown bat, muskrat, and mink are also used as indicator species in the refinement process. The SLERA concluded that the potential for risk to Canada goose, which was the indicator species for avian herbivores, was below the threshold for concern. The indicator species identified above are associated with wetland and aquatic habitats.

The refinement process includes assessment of the potential risk for six additional indicator species exposed to aroclors and congeners in soil in the North-Central Devil's Swamp AOI and Drainage Ditch AOI. The six indicator species are discussed below. Information on the indicator species are from USEPA (1999a).

American woodcock (*Scolopax minor*) was selected as the indicator species for avian insectivores. This is a relatively small-bodied charadiiform bird (0.18 kg) that forages exclusively on earthworms and other soil invertebrates. American woodcock inhabits a



variety of habitats, including intermittently and permanently flooded forests. American woodcock was selected as the indicator species for avian insectivores that forage in terrestrial habitats.

Short-tailed shrew (*Blarina brevicauda*) is a small-bodied mammal (0.02 kg) with a high rate of food ingestion and small feeding territory. The diet of short-tailed shrew consists primarily of earthworms and soil invertebrates, but also includes some fruit and other vegetative material. Habitats for short-tailed shrew include grasslands and forests. Short-tail shrew is an important prey item for carnivores that feed on small mammals. Short-tailed shrew was selected as the indicator species for mammalian insectivores that forage in terrestrial habitats.

Northern bobwhite (*Colinus virginianus*) is a small-bodied (0.019 kg) galliform that inhabits forests and other terrestrial habitats. The diet of northern bobwhite consists primarily of grains, fruits, and forage, but may also include soil invertebrates. Northern bobwhite was selected as the indicator species for avian herbivores that forage in terrestrial habitats.

Deer mouse (*Peromyscus maniculatus*) is a small-bodied rodent (0.02 kg) that occurs in variety of habitats, including forests. The diet of deer mouse consists of a variety of vegetative material, including forage, grain, exposed fruits, and roots. Deer mouse may also feed on soil invertebrates. Similar to the short-tailed shrew, deer mice are an important prey item of avian and mammalian carnivores that feed on small mammals. Deer mouse was selected as the indicator species for mammalian herbivores that forage in terrestrial habitats.

Red-tailed hawk (*Buteo jamaicensis*) is a relatively large-bodied raptor (1.13 kg) that forages for small mammals. In addition to small mammals, red-tailed hawk also forages on earthworms and other soil invertebrates. The red-tailed hawk has societal value as a raptor and plays an important role in maintaining populations and communities of small mammals. Red-tailed hawk was selected as the indicator species for avian carnivores that forage in terrestrial habitats.

Red fox (*Vulpes vulpes*) is a relatively large bodied canid (4.53 kg) that inhabits a variety of habitats, including grasslands and forests. The diet of red fox consists primarily of small mammals, but also includes small birds, earthworms and soil invertebrates, and exposed fruit. Like red-tailed hawk, red fox plays an important role in maintaining populations and communities of small mammals. Red fox was selected as the indicator species for mammalian carnivores that forage in terrestrial habitats.

### Exposure Estimates

Ingestion of PCB aroclors and congeners by upper trophic level receptors was calculated using the general equation:

$$IR_{total} = IR_{food} \times Conc_{food} + IR_{water} \times Conc_{water} + IR_{sediment/soil} \times Conc_{sediment/soil} \times AUF \quad (\text{Eq. 6})$$

Where:

$IR_{total}$	=	total ingestion rate (IR) (mg per kg body weight [BW] per day [mg/kg-day]);
$IR_{food}$	=	rate of food ingestion (kg WW/kg-day);
$IR_{water}$	=	rate of water ingestion (L/kg-day);
$IR_{sediment/soil}$	=	rate of sediment or soil ingestion (kg DW/kg-day);
$Conc_{food}$	=	concentration in food (mg/kg WW);
$Conc_{water}$	=	concentration in surface water (mg/L);
$Conc_{sediment/soil}$	=	concentration in sediment or soil (mg/kg DW); and
AUF	=	Area Use Factor

Ingestion of food and water is expressed on a wet weight basis. The rate of sediment or soil ingestion ( $IR_{sediment/soil}$ ) is expressed on a dry weight basis. The rates of food and water ingestion for each indicator species were taken from EPA (1999a) and scaled for body mass following Nagy (1987). The calculation of ingestion rates for avian and mammalian receptors is attached in Appendix D.

For each indicator species,  $IR_{total}$  was calculated for each of the individual aroclors and congeners. Whereas the SLERA assumed that avian and mammalian receptors ingested only one type of food (i.e., invertebrates, plant material, or fish), the refinement process considers ingestion of multiple types of food. Information on diet for each indicator species was obtained from USEPA (1999a), which identifies the maximum and minimum percentages for a variety of prey dietary items. In general, the minimum percentage was assigned to an indicator species for each secondary dietary type, with the remainder of its diet consisting of the primary dietary type. Based on this approach,  $IR_{All\ Food}$  is defined by the equation:

$$IR_{All\ Food} = \sum_{i=1}^n IR_{Diet\ Item\ i} \quad (\text{Eq. 7})$$

Where:

$IR_{All\ Food}$	=	food ingestion rate (IR) (mg per kg body weight [BW] per day [mg/kg-day]);
$IR_{Diet\ Item\ i}$	=	rate of ingestion of the $i^{th}$ diet item (mg WW/kg-day);
$n$	=	number of diet items

The SLERA assumed that all food ingested by all indicator species was obtained from the AOI being evaluated. For species with small foraging ranges, this is a reasonable assumption. However, for species with large foraging ranges, such as piscivores and carnivores, this assumption overestimates ingestion of COPECs. To provide a more realistic estimate of ingestion of COPECs, the refinement process considered area use factors (AUFs) for each indicator species. USEPA (1999) identifies the minimum and maximum, as well as the midpoint, of the home ranges of each indicator species. For the refinement process, the midpoint was selected as the foraging range of the indicator species. The AUF is defined as:

$$AUF \equiv \frac{Foraging\ Range}{Area\ of\ AOI} \quad (Eq. 8)$$

The areas of the four AOIs are:

North-Central Devil's Swamp AOI	15.05 hectares
Drainage Ditch AOI	0.4642 hectare
North Devil's Swamp Lake AOI	5.0 hectares
South Devil's Swamp Lake AOI	4.0 hectares

To assess the potential for risk, the  $IR_{total}$ , calculated using Equation 6, was divided by the TRVs identified in Table 3-1 (avian receptors) or Table 3-2 (mammalian receptors) to produce a hazard quotient (HQ) for the individual aroclors:

$$HQ \equiv \frac{IR_{total}}{TRV} \quad (Eq. 9)$$

The HQs for the individual aroclors were summed to produce a hazard index (HI) for total PCBs. An HQ or HI less than or equal to unity (1.0) indicates the potential for risk is below the threshold for concern. An HQ or HI greater than unity indicates a potential for risk.

Table 3-15 and Table 3-16 identify diets and foraging ranges for avian receptors and mammalian receptors, respectively.

## 4.0 REFINEMENT OF COPECS

The following sections include a discussion of the refinement of COPECs in each AOI in each media.

### 4.1 NORTH-CENTRAL DEVIL'S SWAMP AOI

#### 4.1.1 SURFACE WATER

None of the individual aroclors were detected in any of the 15 surface water samples collected from the North-Central Devil's Swamp AOI. Samples were not analyzed for PCB congeners. Therefore, further refinement of COPECs in the surface water in the North-Central Devil's Swamp AOI is not required.

#### 4.1.2 SEDIMENT

The SLERA identified potential risk to benthic invertebrates, avian and mammalian insectivores, and avian and mammalian piscivores exposed to sediment in the North-Central Devil's Swamp AOI.

##### *Benthic Invertebrates*

Table 4-1 shows a summary of the refinement of risk to benthic invertebrates. One or more aroclors were detected in 14 of the 15 sediment samples from the North-Central Devil's Swamp AOI. Concentrations in five of the 15 samples exceed the ESV of 59.8 µg/kg (consensus TEC). Concentrations of total aroclors in all 15 samples are below the consensus PEC. The concentration of total aroclors in only one sample exceeds the RB, which is midpoint between the TEC and PEC. This single exceedence (369 µg/kg) is negligible, as it is essentially equal to the RB (368 µg/kg).

Due to the absence of ecological benchmarks, risk due to exposure to PCB congeners was not evaluated.

Based on the refinement, it can reasonably be concluded that the concentrations of total aroclors in sediment in the North-Central Devil's Swamp AOI do not pose a potential for risk to benthic invertebrates above the threshold for concern. Therefore, no further evaluation in the BERA is required.

### *Avian Insectivores*

Table 4-2 shows a summary of the refinement of risk to green heron, which is the indicator species for avian insectivores. For aroclors, the HI for the sum of the HQs for both the NOAEL (2.61) and LOAEL (1.34) exceed unity. For congeners, the HI for the NOAEL (7.58) exceeds unity and is below unity for the LOAEL (0.758). These results suggest that aroclors and congeners may pose risk to avian insectivores exposed to sediment in the North-Central Devil's Swamp AOI and further evaluation should be completed in the BERA.

### *Mammalian Insectivores*

Table 4-3 shows a summary of the refinement of risk to little brown bat, which is the indicator species for mammalian insectivores. For aroclors, the HI for the sum of the HQs for the NOAEL (4.39) exceeds unity and is below unity for the LOAEL (0.439). For congeners, the HIs exceed unity for both the NOAEL (117) and the LOAEL (11.7). These results suggest that aroclors and congeners may pose risk to mammalian insectivores exposed to sediment in the North-Central Devil's Swamp AOI and further evaluation should be completed in the BERA.

### *Avian Piscivores*

Table 4-4 shows a summary of the refinement of risk to bald eagle, which is the indicator species for avian piscivores. For aroclors, the HI for the sum of the HQs for the NOAEL (0.484) is below unity, prior to adjustment for area use. When the AUF is applied, the sum of the HQs is reduced to 0.0039. Because the bald eagle is a species of concern, only the NOAEL is considered. For congeners, the HI for the NOAEL (2.04) exceeds unity, prior to adjustment for area use. When the AUF is applied, the HI for the NOAEL (0.017) is below unity. The sample with the highest concentration of total aroclors was also analyzed for PCB congeners.

These results suggest that aroclors and congeners do not pose a potential for risk above the threshold for concern for avian piscivores exposed to sediment in the North-Central Devil's Swamp AOI. However, due to the relatively high degree of uncertainty associated with the calculation of concentrations of PCB aroclors and congeners in fish, the BERA will re-evaluate risk to avian piscivores based on measured concentrations of PCBs in fish and the food chain models revised accordingly.

### *Mammalian Piscivores*

Table 4-5 shows a summary of the refinement of risk to mink, which is the indicator species for mammalian piscivores. For aroclors, the HI for the sum of the HQs for the

NOAEL (9.19) exceeds unity and is below unity for the LOAEL (0.951), without adjustment for area use. When the AUF is applied, the HQs are below unity for both the NOAEL (0.035) and LOAEL (0.004).

For congeners, the HI exceeds unity for the NOAEL (9.16) and is below unity for the LOAEL (0.916), prior to adjustment for area use. When the AUF is applied, the HIs are below unity for both the NOAEL (0.035) and the LOAEL (0.003).

These results suggest that aroclors and congeners do not pose a potential for risk above the threshold for concern for mammalian piscivores exposed to sediment in the North-Central Devil's Swamp AOI. However, due to the relatively high degree of uncertainty associated with the calculation of concentrations of PCB aroclors and congeners in fish, the BERA will re-evaluate risk to mammalian piscivores based on measured concentrations of PCBs in fish and the food chain models revised accordingly.

#### **4.1.3      SOIL**

The SLERA included an evaluation of nine of the 15 solid samples collected from the North-Central Devil's Swamp AOI as soil. The SLERA determined that the concentrations of aroclors and PCB congeners in soil in the North-Central Devil's Swamp AOI did not pose a potential for risk to soil invertebrates, terrestrial plants, or avian and mammalian receptors above the potential for concern. Therefore, further refinement of COPECs in soil in the North-Central Devil's Swamp AOI is not required.

### **4.2          DRAINAGE DITCH AOI**

#### **4.2.1      SURFACE WATER**

Two aroclors were detected in surface water samples collected in the Drainage Ditch AOI. Aroclor 1254 was detected in ten of 12 samples and Aroclor 1260 was detected in one sample. Based on a maximum concentration of total aroclors (0.22 µg/L) that exceeded the ESVs for fish (0.2 µg/L) and aquatic plants (0.144 µg/L), the SLERA identified total aroclors as a COPEC.

Table 4-6 summarizes the refinement of total aroclors in surface water. The RB for fish is 0.369 µg/L, which is the geometric mean of EC<sub>20</sub>, EC<sub>25</sub> for bass, and LCV identified by Suter and Tsao (1996). The maximum concentration of 0.22 µg/L is below this RB. Therefore, it can be concluded that the concentrations of total aroclors in surface water

of the Drainage Ditch AOI do not pose a potential for risk to fish above the threshold for concern.

The ESV for aquatic plants used in the SLERA is the LCV of 0.144 µg/L identified by Suter and Tsao (1996). No additional ecological benchmarks specific to aquatic plants were identified. Only the maximum concentration of 0.22 µg/L exceeds the ESV. The 95 percent UCL of 0.162 µg/L is slightly greater than the ESV. The arithmetic mean (0.092 µg/L), median (0.098 µg/L), and geometric mean (0.063 µg/L) concentrations are all below the ESV. As observed during the Site visit conducted for the SLERA, limited vegetation is present within the channel of the Drainage Ditch, where the surface water samples were collected. The relative absence of vegetation appears to be the result of physical stressors (e.g., surface water flow). Based on a single exceedence of a conservative ESV and likely occurrence of physical stressors that may limit the establishment and maintenance of aquatic vegetation within the channel, it can reasonably be concluded that concentrations of total aroclors in the surface water of the Drainage Ditch AOI do not pose a potential for risk to aquatic plants above the threshold for concern.

Due to the absence of ecological benchmarks, risk due to exposure to PCB congeners in surface water was not evaluated.

Based on the results of the SLERA and refinement, no further evaluation of risk to aquatic invertebrates, fish, and aquatic plants due to total aroclors in surface water is not warranted and will not be addressed in the BERA.

#### **4.2.2      SEDIMENT**

The SLERA identified potential risk to benthic invertebrates, avian and mammalian insectivores, and avian and mammalian piscivores exposed to sediment in the Drainage Ditch AOI. For avian and mammalian herbivores, the SLERA did not identify a potential for risk due to aroclors or PCB congeners above the threshold for concern. The potential for risk to herbivores due to congeners is uncertain because the sample with the maximum concentration of total aroclors was not analyzed for congeners.

##### **Benthic Invertebrates**

Table 4-7 shows a summary of the refinement of risk to benthic invertebrates. Concentrations of total aroclors in nine of the 12 samples exceed the TEC (59.8 µg/L).



Concentrations in six samples exceed the PEC (676 µg/L). Concentrations in seven samples exceed the midpoint of the TEC and PEC (368 µg/L), which is the RB.

Due to the absence of ecological benchmarks, risk due to exposure to PCB congeners in sediment was not evaluated.

Based on the refinement, concentrations of total aroclors in sediment of the Drainage Ditch AOI potentially pose risk to benthic invertebrates and should be evaluated further in the BERA.

#### *Avian Insectivores*

Table 4-8 shows a summary of the refinement of risk to green heron, which is the indicator species for avian insectivores. For aroclors, the HI for the sum of the HQs for both the NOAEL (121) and LOAEL (29.1) exceed unity, prior to adjustment for area use. When the AUF is applied, the HI for the NOAEL (12.1) and LOAEL (2.91) still exceed unity. For congeners, the HI for the NOAEL (23.3) and LOAEL (2.33) exceed unity, prior to adjustment for area use. When the AUF is applied, the HI for NOAEL (2.33) still exceeds unity, while the HQ for the LOAEL (0.233) is below unity. These results suggest that aroclors and congeners may pose risk to avian insectivores exposed to sediment in the Drainage Ditch AOI and further evaluation should be completed in the BERA.

#### *Mammalian Insectivores*

Table 4-9 shows a summary of the refinement of risk to little brown bat, which is the indicator species for mammalian insectivores. For aroclors, the HI for the sum of the HQs for both the NOAEL (190) and LOAEL (18.9) exceed unity. For congeners, the HI also exceeds unity for both the NOAEL (1,864) and the LOAEL (186). These results suggest that aroclors and congeners may pose risk to mammalian insectivores exposed to sediment in the Drainage Ditch AOI and further evaluation should be completed in the BERA.

#### *Avian Piscivores*

Table 4-10 shows a summary of the refinement of risk to belted kingfisher, which is the indicator species for avian piscivores. For aroclors, the HI for the sum of the HQs for both the NOAEL (78.9) and LOAEL (20.6) exceeds unity, prior to adjustment for area use. When the AUF is applied, the HI for both the NOAEL (7.89) and the LOAEL (2.06) still exceed unity. For congeners, the HIs for both the NOAEL (0.477) and LOAEL (0.048) are below unity, prior to adjustment for area use. When the AUF is applied, the HQs are 0.048 and 0.0048 for the NOAEL and LOAEL, respectively. Only three of the 12 sediment samples collected from the Drainage Ditch AOI were analyzed for congeners.

The sample with the maximum concentration of total aroclors was not analyzed for congeners. Therefore, the potential for risk to avian piscivores based on current data is uncertain.

These results suggest that aroclors and congeners may pose a potential for risk above the threshold for concern for avian piscivores exposed to sediment in the Drainage Ditch AOI. Therefore, further evaluation in the BERA is required.

### **Mammalian Piscivores**

Table 4-11 shows a summary of the refinement of risk to mink, which is the indicator species for mammalian piscivores. For aroclors, the HI for the sum of the HQs for both the NOAEL (249) and LOAEL (29.2) exceed unity, prior to adjustment for area use. When the AUF is applied, the HIs for the NOAEL (0.025) and LOAEL (0.003) are below unity. For congeners, the HIs for both the NOAEL (149) and LOAEL (14.9) exceed unity, prior to adjustment for area use. When the AUF is applied, the HIs for the NOAEL (0.015) and LOAEL (0.001) are below one.

These results suggest that aroclors and congeners do not pose a potential for risk above the threshold for concern for avian piscivores exposed to sediment in the Drainage Ditch AOI. Given the small size of the AOI (0.4642 hectare), large foraging range of mammalian piscivores, and variability of flow, additional evaluation of risk to this receptor group exposed to sediment in the Drainage Ditch AOI is not warranted.

### **4.2.3      SOIL**

Six samples collected in the Drainage Ditch AOI were evaluated as soil. Aroclor 1254 was detected in all six samples and Aroclor 1260 was detected in two samples. The SLERA identified total aroclors as a COPEC for soil because the maximum concentration of 750 µg/kg exceeded the ESV of 650 µg/kg for wildlife. The maximum concentration was below the ESVs for soil invertebrates and terrestrial plants. Food chain models were not used in the SLERA.

### **Avian Insectivores**

Table 4-12 shows a summary of the refinement of risk to American woodcock, which is the indicator species for avian insectivores. For aroclors, the HI for the sum of the HQs for both the NOAEL (6.02) and LOAEL (1.21) exceed unity, prior to adjustment for area use. When the AUF is applied, the HIs for the both the NOAEL (0.033) and LOAEL (0.007) are below one. For congeners, the HIs for both the NOAEL (0.230) and LOAEL

(0.023) are below unity. These results suggest that aroclors and congeners do not pose risk to avian insectivores exposed to soil in the Drainage Ditch AOI above the threshold for concern and further evaluation in the BERA is not warranted.

#### **Mammalian Insectivores**

Table 4-13 shows a summary of the refinement of risk to short-tailed shrew, which is the indicator species for mammalian insectivores. For aroclors, the HI for the sum of the HQs for both the NOAEL (21.3) and LOAEL (1.88) exceed unity, prior to adjustment for area use. When the AUF is applied, the HI for the NOAEL (10.9) exceeds unity whereas the HQ for the LOAEL (0.956) is below unity. For congeners, the HQs for both the NOAEL (0.344) and LOAEL (0.034) are below unity.

These results suggest that aroclors may pose a potential for risk to mammalian insectivores exposed to soil in the Drainage Ditch AOI above the threshold for concern. The potential for risk posed by congeners is uncertain. Only one of the samples evaluated as soil was analyzed for congeners. This was not the sample with the maximum concentration of total aroclors. Based on the results of the refinement, potential risk posed by aroclors and congeners to mammalian insectivores exposed to soil in the Drainage Ditch AOI should be evaluated further in the BERA.

#### **Avian Herbivores**

Table 4-14 shows a summary of the refinement of risk to northern bobwhite, which is the indicator species for avian herbivores. For aroclors, the HI for the sum of the HQs for the NOAEL (1.08) exceeds unity and the LOAEL (0.217) is below unity, prior to adjustment for area use. When the AUF is applied, the HI for both the NOAEL (0.045) and LOAEL (0.009) are below unity. For congeners, the HIs for both the NOAEL (0.041) and LOAEL (0.004) are below unity. These results suggest that aroclors and congeners do not pose risk to avian herbivores exposed to soil in the Drainage Ditch AOI above the threshold for concern and further evaluation in the BERA is not warranted.

#### **Mammalian Herbivores**

Table 4-15 shows a summary of the refinement of risk to deer mouse, which is the indicator species for mammalian herbivores. For aroclors, the HI for the sum of the HQs for the NOAEL (9.57) exceeds unity, whereas the sum of the HQs for the LOAEL (0.957) is below unity. For congeners, the HIs for both the NOAEL (0.166) and LOAEL (0.017) are both below unity.

These results suggest that aroclors may pose a potential for risk to mammalian herbivores exposed to soil in the Drainage Ditch AOI above the threshold for concern.

The potential for risk posed by congeners is uncertain. Only one of the samples evaluated as soil was analyzed for congeners. This was not the sample with the maximum concentration of total aroclors. Based on the results of the refinement, potential risk posed by aroclors and congeners to mammalian herbivores should be evaluated further in the BERA.

### *Avian Carnivores*

Table 4-16 shows a summary of the refinement of risk to red-tailed hawk, which is the indicator species for avian carnivores. For aroclors, the HI for the sum of the HQs for the NOAEL (1.86) exceeds unity and the LOAEL (0.374) is below unity, prior to adjustment for area use. When the AUF is applied, the HIs for both the NOAEL (0.0007) and the LOAEL (0.0001) are below one. For congeners, the sum of the HIs for both the NOAEL (0.071) and LOAEL (0.007) is below unity.

These results suggest that aroclors and congeners do not pose a potential for risk above the threshold for concern for avian carnivores exposed to soil in the Drainage Ditch AOI. Although only one soil sample was analyzed for congeners, the large foraging range of red-tailed hawk, and other avian carnivores that feed on small mammals, relative to the size of the AOI, it is unlikely that additional analysis for congeners in soil will significantly change the results. Therefore, further analysis of risk to avian carnivores exposed to soil in the Drainage Ditch AOI in the BERA is not warranted.

### *Mammalian Carnivores*

Table 4-17 shows a summary of the refinement of risk to red fox, which is the indicator species for mammalian carnivores. For aroclors, the HI for the sum of the HQs for both the NOAEL (9.43) and LOAEL (1.15) exceed unity, prior to adjustment for area use. When the AUF is applied, the HIs for the NOAEL (0.003) and LOAEL (0.0003) are both below one. For congeners, the sum of the HIs for both the NOAEL (0.345) and LOAEL (0.033) is below unity.

These results suggest that aroclors and congeners do not pose a potential for risk above the threshold for concern for mammalian carnivores exposed to soil in the Drainage Ditch AOI. Although only one soil sample was analyzed for congeners, the large foraging range of red fox, and other mammalian carnivores that feed on small mammals, relative to the size of the AOI, it is unlikely that additional analysis for congeners in soil will significantly change the results. Therefore, further analysis of risk to mammalian carnivores exposed to soil in the Drainage Ditch AOI in the BERA is not warranted.

### **4.3        NORTH DEVIL’S SWAMP LAKE AOI**

#### **4.3.1      SURFACE WATER**

Aroclor-1016 was detected in one of the 15 surface water samples collected from the North Devil’s Swamp Lake AOI. No other aroclor was detected. The single detected Aroclor-1016 was below the ESVs for invertebrates, fish, and aquatic plants. Samples were not analyzed for PCB congeners. Therefore, further refinement of COPECs in the surface water of the North Devil’s Swamp Lake AOI is not required.

#### **4.3.2      SEDIMENT**

The SLERA identified potential risk to benthic invertebrates, avian and mammalian insectivores, mammalian herbivores, and avian and mammalian piscivores exposed to sediment in the North Devil’s Swamp Lake AOI. For avian and mammalian herbivores, the SLERA did not identify a potential for risk due to PCB congeners above the threshold for concern. The potential for risk to herbivores due to congeners is uncertain because only four of the 15 samples were analyzed for congeners and the sample with the maximum concentration of total aroclors was not analyzed for congeners.

##### **Benthic Invertebrates**

Table 4-18 shows a summary of the refinement of risk to benthic invertebrates. Concentrations of total aroclors in all 15 samples exceed the TEC (59.8 µg/L). Concentrations in four samples exceed the PEC (676 µg/L). Concentrations in eight samples exceed the midpoint of the TEC and PEC (368 µg/L), which is the RB.

Due to the absence of ecological benchmarks, risk from exposure to PCB congeners was not evaluated.

Based on the refinement, concentrations of total aroclors in sediment of the North Devil’s Swamp Lake AOI potentially pose risk to benthic invertebrates and should be evaluated further in the BERA.

##### **Avian Insectivores**

Table 4-19 shows a summary of the refinement of risk to green heron, which is the indicator species for avian insectivores. For aroclors, the HI for the sum of the HQs for both the NOAEL (29.5) and LOAEL (5.28) exceed unity. For congeners, the HIs for both the NOAEL (11.1) and LOAEL (1.11) exceed unity. These results suggest that aroclors

and congeners may pose risk to avian insectivores exposed to sediment in the North Devil's Swamp Lake AOI and further evaluation should be completed in the BERA.

#### *Mammalian Insectivores*

Table 4-20 shows a summary of the refinement of risk to little brown bat, which is the indicator species for mammalian insectivores. For aroclors, the HI for the sum of the HQs for both the NOAEL (39.8) and LOAEL (3.96) exceed unity. For congeners, the HI also exceeds unity for both the NOAEL (180) and the LOAEL (18.0). These results suggest that aroclors and congeners may pose risk to mammalian insectivores exposed to sediment in the North Devil's Swamp Lake AOI and further evaluation should be completed in the BERA.

#### *Mammalian Herbivores*

Table 4-21 shows a summary of the refinement of risk to muskrat, which is the indicator species for mammalian herbivores. For aroclors, the HI for the sum of the HQs for the NOAEL (4.67) exceeds unity and is below unity for the LOAEL (0.467). For congeners, the HI exceeds unity for both the NOAEL (15.4) and the LOAEL (1.54). These results suggest that aroclors and congeners may pose risk to mammalian herbivores exposed to sediment in the North Devil's Swamp Lake AOI and further evaluation should be completed in the BERA.

#### *Avian Piscivores*

Table 4-22 shows a summary of the refinement of risk to bald eagle, which is the indicator species for avian piscivores. For aroclors, the HI for the sum of the HQs for the NOAEL (5.41) exceeds unity, prior to adjustment for area use. When an AUF is applied, the HI is reduced to 0.015. Because bald eagle is a species of concern, only the NOAEL is considered. For congeners, the HI for the NOAEL (2.04) exceeds unity, prior to adjustment for area use. When the AUF is applied, the HI is 0.006. The sample with the highest concentration of total aroclors was also analyzed for PCB congeners.

These results suggest that aroclors and congeners do not pose a potential for risk above the threshold for concern for avian piscivores exposed to sediment in the North Devil's Swamp Lake AOI. Although the sum of the HQs exceeded unity prior to adjustment for area use, it is unlikely that bald eagle would obtain all its diet from the North Devil's Swamp Lake AOI. The midpoint of the home range sizes identified by USEPA (1999) is 1,855 hectares; the North Devil's Swamp Lake AOI is 5.0 hectares. However, due to the relatively high degree of uncertainty associated with the calculation of concentrations of PCB aroclors and congeners in fish, the BERA will re-evaluate risk to avian piscivores based on measured concentrations of PCBs in fish.

### **Mammalian Piscivores**

Table 4-23 shows a summary of the refinement of risk to mink, which is the indicator species for mammalian piscivores. For aroclors, the HI for the sum of the HQs for both the NOAEL (28.6) and LOAEL (4.26) exceed unity, prior to adjustment for area use. When the AUF is applied, the HIs are below unity for both the NOAEL (0.037) and LOAEL (0.006).

For congeners, the HIs for both the NOAEL (15.0) and LOAEL (1.50) exceed unity prior to adjustment for area use. The HIs are below unity for both the NOAEL (0.019) and the LOAEL (0.002) when the AUF is applied.

These results suggest that aroclors and congeners do not pose a potential for risk above the threshold for concern for mammalian piscivores exposed to sediment in the North Devil's Swamp Lake AOI. However, due to the relatively high degree of uncertainty associated with the calculation of concentrations of PCB aroclors and congeners in fish, the BERA will re-evaluate risk to mammalian piscivores based on measured concentrations of PCBs in fish.

### **4.3.3      SOIL**

None of the solid samples collected from the North Devil's Swamp Lake AOI were determined to be soil. Therefore, no refinement was required.

## **4.4          SOUTH DEVIL'S SWAMP LAKE AOI**

### **4.4.1      SURFACE WATER**

None of the individual aroclors were detected in any of the ten surface water samples collected from the South Devil's Swamp Lake AOI. Samples were not analyzed for PCB congeners. Therefore, further refinement of COPECs in the surface water in the South Devil's Swamp Lake AOI is not required.

### **4.4.2      SEDIMENT**

The SLERA identified potential risk to benthic invertebrates, avian and mammalian insectivores, and avian and mammalian piscivores exposed to sediment in the South

Devil's Swamp Lake AOI. The potential for risk to avian and mammalian herbivores is uncertain. The sample with the maximum concentration of total aroclors was not analyzed for PCB congeners.

### **Benthic Invertebrates**

Table 4-24 shows a summary of the refinement of risk to benthic invertebrates. One or more aroclors were detected in all ten of the sediment samples from the South Devil's Swamp Lake AOI. Concentrations in six of the ten samples exceed the ESV of 59.8 µg/kg (consensus TEC). Concentrations of total aroclors in all ten samples are below the consensus PEC and the midpoint of the TEC and PEC.

Due to the absence of ecological benchmarks, risk from exposure to PCB congeners was not evaluated.

Based on the refinement, it can reasonably be concluded that the concentrations of total aroclors in the South Devil's Swamp Lake AOI do not pose a potential for risk to benthic invertebrates above the threshold for concern. Therefore, no further evaluation in the BERA is required.

### **Avian Insectivores**

Table 4-25 shows a summary of the refinement of risk to green heron, which is the indicator species for avian insectivores. For aroclors, the HI for the sum of the HQs for the NOAEL (2.56) exceeds unity, and the sum of the HQs for the LOAEL (0.552) is below unity. For congeners, the HI for the NOAEL (5.73) exceeds unity and is below unity for the LOAEL (0.573). These results suggest that aroclors and congeners may pose risk to avian insectivores exposed to sediment in the South Devil's Swamp Lake AOI and further evaluation should be completed in the BERA.

### **Mammalian Insectivores**

Table 4-26 shows a summary of the refinement of risk to little brown bat, which is the indicator species for mammalian insectivores. For aroclors, the HI for the sum of the HQs for the NOAEL (3.42) exceeds unity, and the sum of the HQs for the LOAEL (0.341) is below unity. For congeners, the HI exceeds unity for both the NOAEL (111) and the LOAEL (11.1). These results suggest that aroclors and congeners may pose risk to mammalian insectivores exposed to sediment in the South Devil's Swamp Lake AOI and further evaluation should be completed in the BERA.



### *Avian Piscivores*

Table 4-27 shows a summary of the refinement of risk to bald eagle, which is the indicator species for avian piscivores. For aroclors, the HI for the sum of the HQs for the NOAEL (0.562) is below unity, prior to adjustment for area use. When an AUF is applied, the sum of the HI is reduced to 0.0012. Because bald eagle is a species of concern, only the NOAEL is considered.

For congeners, the sum of the HQs for the NOAEL (1.05) exceeds unity, prior to adjustment for area use. When the AUF is applied, the HQ is 0.0023. The sample with the highest concentration of total aroclors was not analyzed for PCB congeners.

These results suggest that aroclors and congeners do not pose a potential for risk above the threshold for concern for avian piscivores exposed to sediment in the South Devil's Swamp Lake AOI. However, due to the relatively high degree of uncertainty associated with the calculation of concentrations of PCB aroclors and congeners in fish, the BERA will re-evaluate risk to avian piscivores based on measured concentrations of PCBs in fish.

### *Mammalian Piscivores*

Table 4-28 shows a summary of the refinement of risk to mink, which is the indicator species for mammalian piscivores. For aroclors, the HI for the sum of the HQs for the NOAEL (3.88) exceeds unity and is below unity for the LOAEL (0.496), prior to adjustment for area use. When the AUF is applied, the HIs are below unity for both the NOAEL (0.004) and LOAEL (0.0005).

For congeners, the HI for the NOAEL (8.80) exceeds unity and the HI is below unity for the LOAEL (0.880), prior to adjustment for area use. The HQs are below unity for both the NOAEL (0.009) and the LOAEL (0.001) when the AUF is applied.

These results suggest that aroclors and congeners do not pose a potential for risk above the threshold for concern for mammalian piscivores exposed to sediment in the South Devil's Swamp Lake AOI. However, due to the relatively high degree of uncertainty associated with the calculation of concentrations of PCB aroclors and congeners in fish, the BERA will re-evaluate risk to mammalian piscivores based on measured concentrations of PCBs in fish.

#### **4.4.3      SOIL**

None of the solid samples collected from the South Devil's Swamp Lake AOI were determined to be soil. Therefore, no refinement was required.

## 5.0 ECOSYSTEMS AT RISK

The Site is a large, diverse ecosystem consisting primarily of palustrine forested wetlands and open water habitats. The primary receptors potentially at risk in one or more of the AOIs are benthic invertebrates exposed to sediment and avian and mammalian insectivores that forage on benthic invertebrates. The benthic community provides an important source of food not only for avian and mammalian insectivores, but also for fish. If risk to benthic invertebrates reduces the availability of food for vertebrate receptors, the Site ecosystem is also likely to be adversely affected. Similarly, many species of avian and mammalian insectivores are prey for upper trophic level receptors. Any impacts that significantly reduce the availability of prey for upper trophic level receptors may also adversely affect the Site ecosystem.

During the Site visit for the SLERA, an active bald eagle nest was observed adjacent to the North Devil's Swamp Lake AOI. Bald eagles likely forage throughout the North-Central Devil's Swamp AOI, North Devil's Swamp Lake AOI, and South Devil's Swamp Lake AOI. The greatest risk to upper trophic level receptors, such as the bald eagle, is biomagnification of PCBs through the food web. For example, fish consumed by piscivores are expected to have a higher concentration of PCBs than sediment. Biomagnification may also result in reduced reproductive success of upper trophic level receptors, which may have any adverse effect on the Site ecosystem.

## 6.0 SELECTION OF ASSESSMENT ENDPOINTS

Section 2.2 included a summary of the assessment endpoints considered in the Problem Formulation. The refinement process identified those pathways that have a potential to pose risk to ecological receptors based on the results of the Tier 1 RI sample results. The refinement process also identified those pathways that are complete but do not pose risk above the threshold for concern. The pathways that potentially pose risk are not the same for all AOIs at the Site. Therefore, assessment endpoints for the BERA are defined for each AOI.

### North-Central Devil's Swamp Lake AOI

- **Sediment**
  - Growth and reproduction of avian and mammalian insectivores
  - Growth and reproduction of avian and mammalian piscivores
  - Sub-lethal toxic effects due to residual concentrations in the tissues of benthic invertebrates and fish

### Drainage Ditch AOI

- **Sediment**
  - Survival, growth and reproduction of benthic invertebrates
  - Growth and reproduction of avian and mammalian insectivores
  - Growth and reproduction of avian and mammalian piscivores
  - Sub-lethal toxic effects due to residual concentrations in the tissues of benthic invertebrates and fish
- **Soil**
  - Growth and reproduction of mammalian insectivores
  - Growth and reproduction of mammalian herbivores

### North Devil's Swamp Lake AOI

- **Sediment**
  - Survival, growth and reproduction of benthic invertebrates
  - Growth and reproduction of avian and mammalian insectivores
  - Growth and reproduction of mammalian herbivores
  - Sub-lethal toxic effects due to residual concentrations in the tissues of benthic invertebrates and fish

**South Devil's Swamp Lake AOI**

- **Sediment**
  - Growth and reproduction of avian and mammalian insectivores
  - Growth and reproduction of avian and mammalian piscivores
  - Sub-lethal toxic effects due to residual concentrations in the tissues of benthic invertebrates and fish

Table 6-1 shows the assessment endpoints for the four AOIs.

## **7.0      CONCEPTUAL SITE MODEL AND RISK QUESTIONS**

The SLERA included a CSM that identified all potentially complete exposure pathways for ecological receptors for surface water, sediment, and soil at the Site. The SLERA identified some of the exposure pathways as complete but having a risk below the threshold for concern (e.g., avian herbivores). The Step 3 Problem Formulation evaluated the remaining pathways by considering additional ecological benchmarks and TRVs and more realistic assumptions regarding exposure of avian and mammalian receptors. Based on the Step 3 Problem Formulation, some additional exposure pathways are eliminated from further evaluation in the BERA.

### **7.1      CONCEPTUAL SITE MODEL**

The CSM presented in the SLERA identified all potentially complete exposure pathways and exposure routes for ecological receptors. With completion of the SLERA and the Step 3 refinement process, a better understanding of those pathways that potentially pose risk to ecological receptors has been achieved. Based on the refinement process, the CSM has been revised for the BERA. A CSM for each AOI has been developed for the BERA. Figures 7-1 through 7-4 show the revised CSMs for the North-Central Devil's Swamp AOI, Drainage Ditch AOI, North Devil's Swamp Lake AOI, and South Devil's Swamp Lake AOI, respectively.

### **7.2      RISK QUESTIONS AND TESTABLE HYPOTHESES**

Risk questions are questions regarding the relationship between assessment endpoints and their predicted responses when exposed to constituents (USEPA 1997). Risk questions provide a more easily understood description of the basis for risk management decisions. However, because risk questions do not provide quantitative decision criteria, they are typically re-stated as testable hypotheses. By stating them as risk hypotheses, it is possible to develop decision rules that explicitly identify acceptable error levels for accepting or rejecting these hypotheses. Table 7-1 shows the key risk questions and test hypotheses for each of the assessment endpoints proposed for the BERA.

## 8.0 ANALYSIS OF UNCERTAINTIES

Evaluation of risk to ecological receptors is typically associated with numerous uncertainties. In the absence of data, assumptions must be made regarding exposure concentrations and responses of ecological receptors to COPECs. To avoid incorrectly dismissing the potential of risk, exposure concentrations and other assumptions are biased toward identifying risk. As a result of this bias, it can be concluded with a high level of certainty that constituents with HQs below or equal to one do not pose risk to ecological receptors. However, a HQ greater than one does not necessarily demonstrate that the risk actually exists; only that further evaluation should be completed.

The refinement of risk to benthic invertebrates was based on comparison of concentrations of total aroclors in individual samples to the midpoint of the TEC (lower effects limit) and PEC (upper effects limit) identified by MacDonald et al. (2000). The TEC and PEC are geometric means of several other lower effects and upper effects limits identified in other sources. As such, they were developed from a variety of datasets representing a variety of geographic areas. The applicability of the TEC and PEC to conditions and the invertebrate communities within the Site assessment area is uncertain.

Several areas of uncertainty are associated with the food chain analyses. These uncertainties include actual concentrations of aroclors and congeners in dietary items, concentrations in soil and sediment samples that were reported as non-detect, lipid concentrations in benthic invertebrates and fish, toxicity of aroclors that lack a TRV, bioavailability, and area use by the indicator species.

Concentrations of aroclors and congeners in benthic and soil invertebrates, aquatic BSAFs and terrestrial plants, fish, and small mammals were estimated using published BCFs. Because these are generic values, the actual concentrations are uncertain. For benthic invertebrates and fish, lipid concentrations of 2 percent and 6 percent, respectively, were assumed. The actual lipid concentrations of these prey items within the Site assessment area is uncertain. To minimize the uncertainty in the calculation of concentrations of PCBs in food consumed by avian and mammalian insectivores and piscivores, invertebrates (i.e., crayfish) and fish will be collected and analyzed for whole body concentrations of PCBs. In the BERA, the food chain models for insectivores and piscivores will be re-evaluated using these measured concentrations.

TRVs were not available for all aroclors. As a conservative assumption, the lowest of the available TRVs was assigned to those aroclors without a TRV. The actual toxicity of

these aroclors and the effect of this assumption on the calculation of the HQs (i.e., overestimated or underestimated) are uncertain.

Some aroclors were not detected in sediment or soil within an AOI. For these aroclors, the midpoint of the minimum and maximum LODs was assigned as the exposure concentration. The effect of this assumption on the calculation of HQs is uncertain.

Bioavailability of aroclors and congeners was conservatively assumed to be 100 percent. Whereas the actual bioavailability is unknown, it is expected to be less than 100 percent. Therefore, the calculated HQs are higher than for actual exposures.

The actual area use of the indicator species is uncertain. For the initial calculation of HQs in the SLERA, 100 percent area use was assumed. This resulted in identification of a potential for risk for some indicator species. When the assumption of 100 percent area use was adjusted based on values presented in USEPA (1999a), the potential for risk fell below the threshold for concern. However, the actual area use by upper trophic level receptors remains uncertain.

All sediment samples were analyzed for aroclors. A subset of samples from each AOI was also analyzed for PCB congeners. For the North-Central Devil's Swamp AOI, four of 15 samples were analyzed for congeners; for the Drainage Ditch AOI, three of 12 samples were analyzed for congeners; for the North Devil's Swamp Lake AOI, four of 15 samples were analyzed for congeners; and for the South Devil's Swamp Lake AOI, three of 10 samples were analyzed for congeners. For the North-Central Devil's Swamp AOI, the sample with the maximum concentration of total aroclors was also analyzed for congeners. For the other three AOIs, the sample with the maximum concentration of total aroclors was not analyzed for congeners. Therefore, the potential for risk to avian and mammalian receptors due to congeners in the Drainage Ditch AOI, North Devil's Swamp Lake AOI, and South Devil's Swamp Lake AOI is uncertain.



## 9.0 CONCLUSIONS

Step 3 (Problem Formulation for the BERA) of the EPA 8-step process for conducting ecological risk assessments (USEPA, 1997) was completed for the Site. The Problem Formulation refined the exposure pathways and ecological receptors identified in the SLERA as potentially at risk. The refinement process considered alternative ecological benchmarks for fish exposed to surface water and benthic invertebrates exposed to sediment. For surface water, measures of central tendency (95 percent UCL, arithmetic average, median, and geometric mean) were also considered. For avian and mammalian receptors, food chain models considered measures of central tendency, diet composition, LOAELs, and area use. One of the primary objectives of the Problem Formulation was to identify data gaps in order to focus development of the Tier 2 RI sampling program on the exposure pathways and receptors for which a potential for risk has been identified or is uncertain.

Separate analyses were conducted for the four AOIs (North-Central Devil's Swamp, Drainage Ditch, North Devil's Swamp Lake, and South Devil's Swamp Lake). The refinement process identified a potential for risk to:

- Benthic invertebrates exposed to aroclors in sediment of the Drainage Ditch AOI and North Devil's Swamp Lake AOI
- Avian and mammalian insectivores exposed to aroclors and congeners in sediment in all four AOIs
- Mammalian herbivores exposed to sediment of the North Devil's Lake Swamp AOI
- Avian and mammalian piscivores exposed to sediment of the Drainage Ditch AOI
- Mammalian insectivores exposed to soil in the Drainage Ditch AOI
- Mammalian herbivores exposed to soil in the Drainage Ditch AOI

The data collection program for the Tier 2 RI and BERA will address the exposure pathways and receptors identified above. Due to the relatively high degree of uncertainty in the calculation of PCB concentrations in benthic invertebrates and fish, the Tier 2 and BERA will include collection and analysis of invertebrates and fish for whole body concentrations of PCBs. These data will be used to re-evaluate the potential of risk to avian and mammalian insectivores and piscivores, even if the analyses presented in this Problem Formulation report did not identify a potential for risk. To facilitate development of the Tier 2 RI, risk questions and testable hypotheses and CSMs for the BERA have been developed as part of the Problem Formulation.

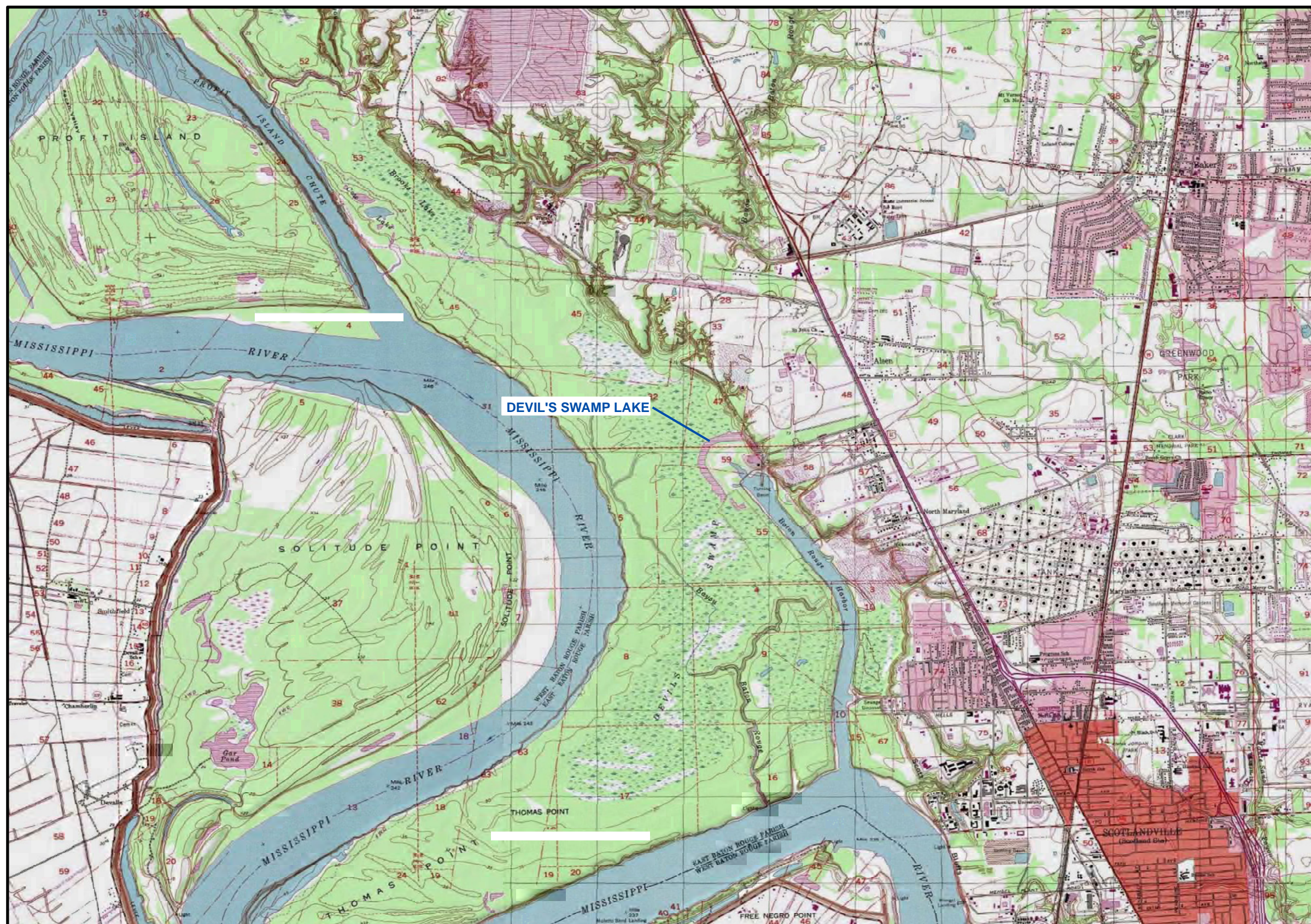
The next step in the 8-step process is development of the study design and data quality objectives for the BERA. This step will include preparation of a Tier 2 RI Work Plan and Sampling and Analysis Plan, for submittal to EPA for review and approval.

## 10.0 REFERENCES

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## FIGURES





LOUISIANA



0 2,000 4,000  
Feet

RE: USGS 7.5 Minute Topographic Maps, Walls, La and Scotlandville, La  
dated 1963, photorevised 1970 and 1980.



55364-00(012)PR-BR001 Oct 18/2011

Figure 1-1  
VICINITY MAP  
DEVIL'S SWAMP LAKE SITE  
EAST BATON ROUGE PARISH, LOUISIANA  
*Baton Rouge Disposal, LLC, Baton Rouge, Louisiana*



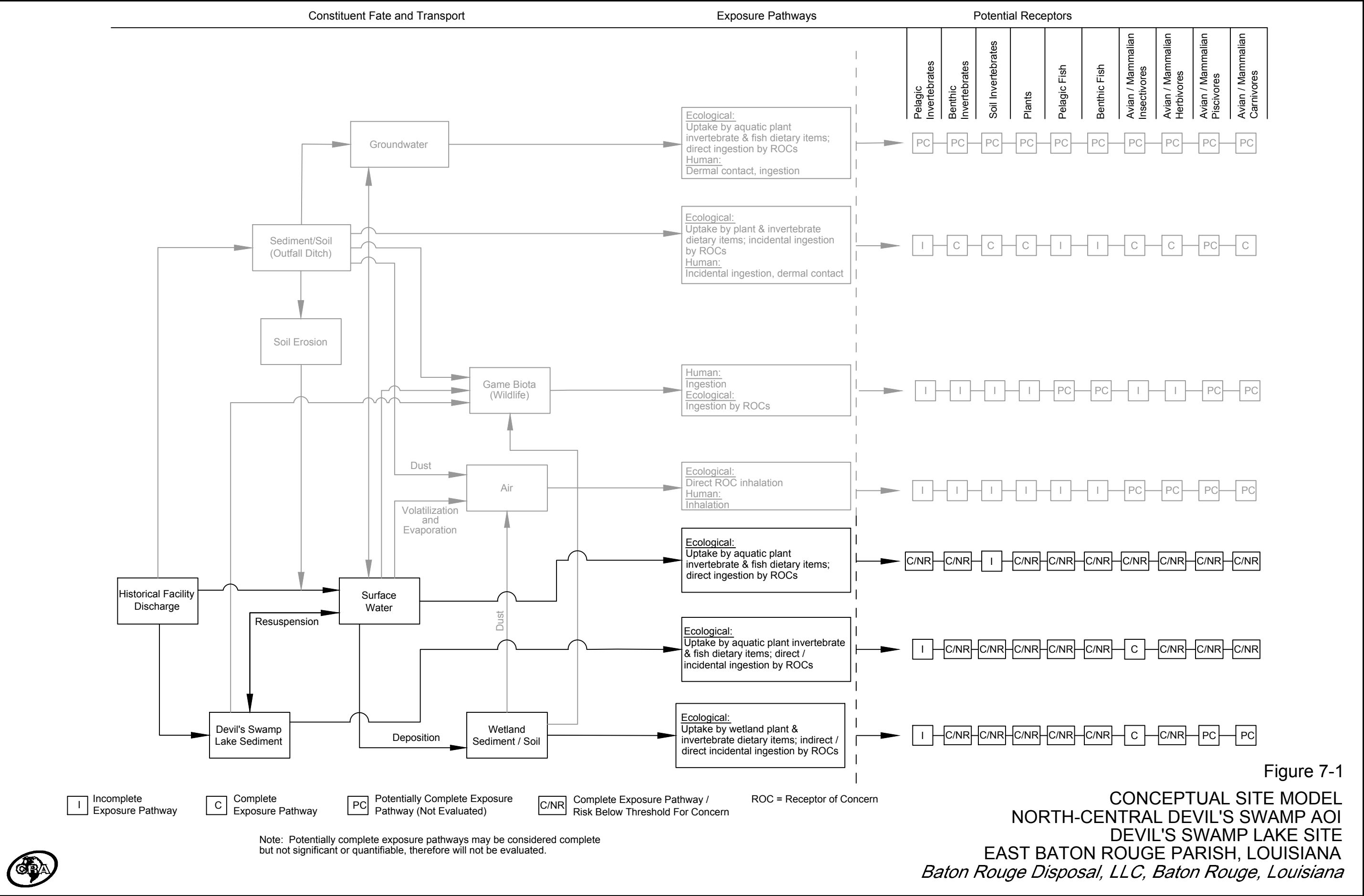


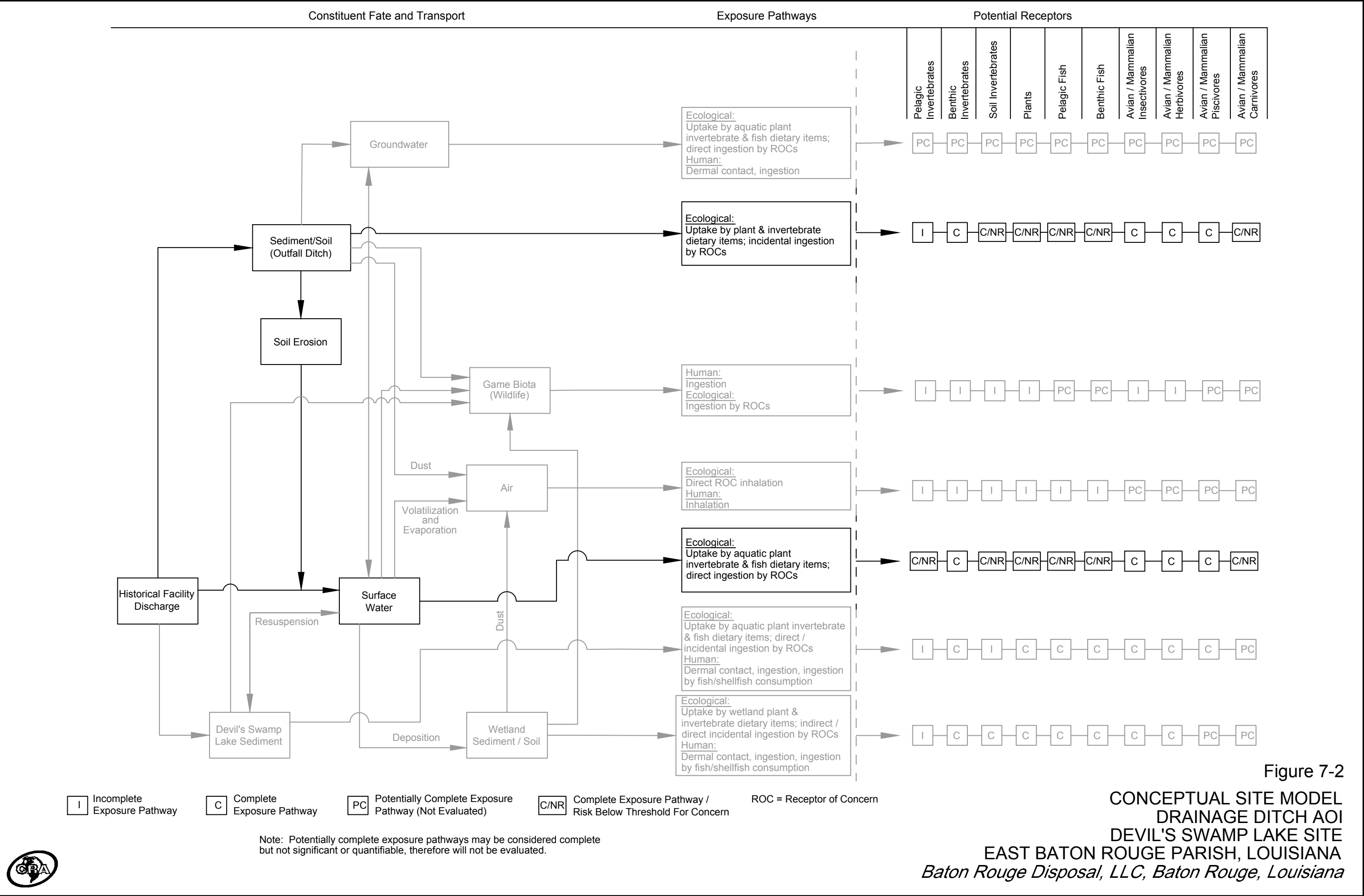
RE: USGS Aerial Photograph dated 2008.

Figure 1-2  
AREAS OF INVESTIGATION  
DEVIL'S SWAMP LAKE SITE  
EAST BATON ROUGE PARISH, LOUISIANA  
*Baton Rouge Disposal, LLC, Baton Rouge, Louisiana*

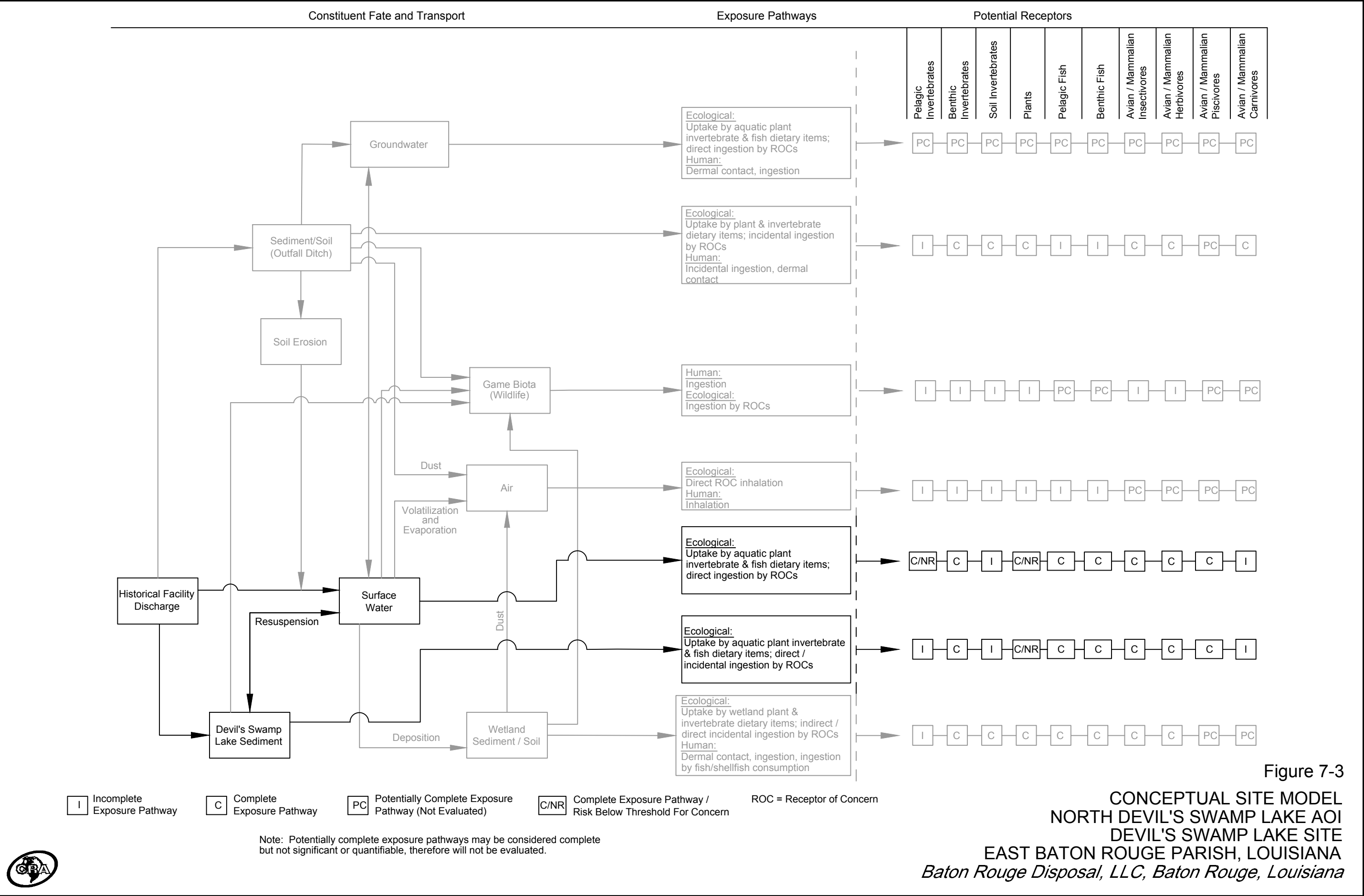


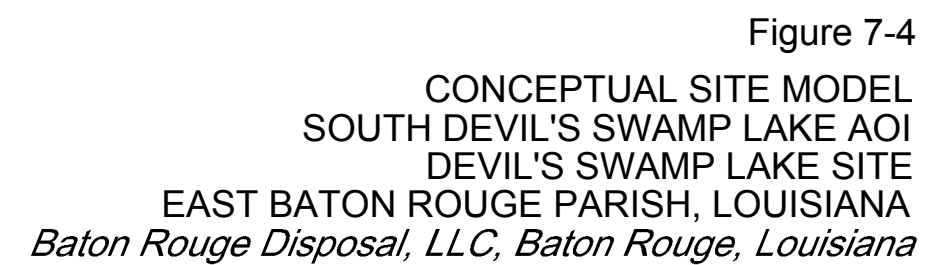












## TABLES

TABLE 2-1

SUMMARY OF SLERA - NORTH-CENTRAL DEVIL'S SWAMP AOI  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

<i>Constituent of Concern</i>	<i>Sediment</i>				
	<i>Benthic Invertebrates</i>	<i>Avian Insectivores</i>	<i>Mammalian Insectivores</i>	<i>Avian Piscivores</i>	<i>Mammalian Piscivores</i>
Aroclor-1016	---	---	---	---	---
Aroclor-1221	---	---	---	---	---
Aroclor-1232	---	---	---	---	---
Aroclor-1242	No ESV	---	---	---	1.3
Aroclor-1248	---	---	---	---	---
Aroclor-1254	2.8	---	2.2	---	---
Aroclor-1260	58	1.6	5.8	---	16
Total Aroclors	6.2	2.9	8.5	3.1	18
PCB Congeners	Not Evaluated	10	295	4.6	26

**Notes:**

- 1) Numerical values in cells is the screening quotient or screening index (total PCBs for food chain models)
  - 2) --- indicates risk not identified
  - 3) No ESV = Aroclor identified as COPEC based on detection and absence of ESV
  - 4) Not Evaluated- risk to receptor group not evaluated
- SLERA = Screening-level ecological risk assessment  
 ESV = Ecological Screening Value  
 PCB = Polychlorinated Biphenyl

TABLE 2-2

SUMMARY OF SLERA - DRAINAGE DITCH AOI  
STEP 3 - PROBLEM FORMULATION  
DEVIL'S SWAMP LAKE SITE  
EAST BATON ROUGE PARISH, LOUISIANA

<i>Constituent of Concern</i>	<i>Surface Water</i>		<i>Sediment</i>							<i>Soil</i>
	<i>Fish</i>	<i>Plants</i>	<i>Benthic Invertebrates</i>	<i>Avian Insectivores</i>	<i>Mammalian Insectivores</i>	<i>Avian Herbivores</i>	<i>Mammalian Herbivores</i>	<i>Avian Piscivores</i>	<i>Mammalian Piscivores</i>	<i>Wildlife</i>
Aroclor-1016	---	---	---	---	---	---	---	---	---	---
Aroclor-1221	---	---	---	---	---	---	---	---	---	---
Aroclor-1232	---	---	---	---	---	---	---	---	---	---
Aroclor-1242	---	---	---	---	---	---	---	---	---	---
Aroclor-1248	---	---	---	---	---	---	---	---	---	---
Aroclor-1254	No ESV	No ESV	28	93	177	---	---	121	95	No ESV
Aroclor-1260	No ESV	No ESV	138	135	111	---	---	49	361	No ESV
Total Aroclors	1.1	1.5	33	350	289	---	---	171	458	
										1.2
PCB Congener	Not Evaluated	Not Evaluated	Not Evaluated	75	4,139	Uncertain	Uncertain	102	359	Not Evaluated

**Notes:**

- 1) Numerical values in cells is the screening quotient or screening index (total PCBs for food chain models)
  - 2) --- indicates risk not identified
  - 3) No ESV - Aroclor identified as COPEC based on detection and absence of ESV
  - 4) Not Evaluated- risk to receptor group not evaluated
- SLERA = Screening level ecological risk assessment  
ESV = Ecological Screening Value  
PCB = Polychlorinated Biphenyl

**TABLE 2-3**  
**SUMMARY OF SLERA - NORTH DEVIL'S SWAMP LAKE AOI**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Constituent of Concern</i>	<i>Sediment</i>						
	<i>Benthic Invertebrates</i>	<i>Avian Insectivores</i>	<i>Mammalian Insectivores</i>	<i>Avian Herbivores</i>	<i>Mammalian Herbivores</i>	<i>Avian Piscivores</i>	<i>Mammalian Piscivores</i>
Aroclor-1016	---	---	---	---	---	---	---
Aroclor-1221	---	---	---	---	---	---	---
Aroclor-1232	---	---	---	---	---	---	---
Aroclor-1242	No ESV	---	---	---	---	1.1	13
Aroclor-1248	---	---	---	---	---	---	---
Aroclor-1254	87	7.5	17	---	---	20	49
Aroclor-1260	56	---	2.2	---	---	1.1	25
Total Aroclors	87	8.5	20	---	1.2	22	87
PCB Congeners	Not Evaluated	12	406	Uncertain	Uncertain	31	37

**Notes:**

- 1) Numerical values in cells is the screening quotient or screening index (total PCBs for food chain models)
  - 2) --- indicates risk not identified
  - 3) No ESV - Aroclor identified as COPEC based on detection and absence of ESV
  - 4) Not Evaluated- risk to receptor group not evaluated
- SLERA = Screening level ecological risk assessment  
ESV = Ecological Screening Value  
PCB = Polychlorinated Biphenyl

TABLE 2-4  
SUMMARY OF SLERA - SOUTH DEVIL'S SWAMP LAKE AOI  
STEP 3 - PROBLEM FORMULATION  
DEVIL'S SWAMP LAKE SITE  
EAST BATON ROUGE PARISH, LOUISIANA

<i>Constituent of Concern</i>	<i>Sediment</i>						
	<i>Benthic Invertebrates</i>	<i>Avian Insectivores</i>	<i>Mammalian Insectivores</i>	<i>Avian Herbivores</i>	<i>Mammalian Herbivores</i>	<i>Avian Piscivores</i>	<i>Mammalian Piscivores</i>
Aroclor-1016	---	---	---	---	---	---	---
Aroclor-1221	---	---	---	---	---	---	---
Aroclor-1232	---	---	---	---	---	---	---
Aroclor-1242	No ESV	---	---	---	---	---	---
Aroclor-1248	---	---	---	---	---	---	---
Aroclor-1254	4.7	1.7	4.0	---	---	---	1.8
Aroclor-1260	16	---	1.8	---	---	---	4.7
Total Aroclors	6.0	2.5	6.1	---	---	1.01	7.4
PCB Congeners	Not Evaluated	4.3	169	Uncertain	Uncertain	1.9	15

**Notes:**

- 1) Numerical values in cells is the screening quotient or screening index (total PCBs for food chain models)
  - 2) --- indicates risk not identified
  - 3) No ESV - Aroclor identified as COPEC based on detection and absence of ESV
  - 4) Not Evaluated- risk to receptor group not evaluated
- SLERA = Screening level ecological risk assessment  
ESV = Ecological Screening Value  
PCB = Polychlorinated Biphenyl

TABLE 3-1

TOXICITY REFERENCE VALUES FOR AVIAN INDICATOR SPECIES  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Green Heron		Belted Kingfisher		Bald Eagle		American Woodcock		Northern Bobwhite		Red-Tailed Hawk	
	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)
Aroclor-1016	0.18	0.36	0.18	0.36	0.18	---	0.18	0.36	0.18	0.36	0.18	0.36
Aroclor-1221	0.18	0.36	0.18	0.36	0.18	---	0.18	0.36	0.18	0.36	0.18	0.36
Aroclor-1232	0.18	0.36	0.18	0.36	0.18	---	0.18	0.36	0.18	0.36	0.18	0.36
Aroclor-1242	<b>0.41</b>	0.36	<b>0.41</b>	0.36	<b>0.41</b>	---	<b>0.41</b>	0.36	<b>0.41</b>	0.36	<b>0.41</b>	0.36
Aroclor-1248	0.18	0.36	0.18	0.36	0.18	---	0.18	0.36	0.18	0.36	0.18	0.36
Aroclor-1254	<b>0.18</b>	<b>1.8</b>	<b>0.18</b>	<b>1.8</b>	<b>0.18</b>	---	<b>0.18</b>	<b>1.8</b>	<b>0.18</b>	<b>1.8</b>	<b>0.18</b>	<b>1.8</b>
Aroclor-1260	0.18	0.36	0.18	0.36	0.18	---	0.18	0.36	0.18	0.36	0.18	0.36
TCDD	<b>0.000014</b>	<b>0.00014</b>	<b>0.000014</b>	<b>0.00014</b>	<b>0.000014</b>	---	<b>0.000014</b>	<b>0.00014</b>	<b>0.000014</b>	<b>0.00014</b>	<b>0.000014</b>	<b>0.00014</b>

## Notes:

1) Bold Font identifies TRV defined by Sample et al. (1996). All other TRVs are the lowest of the aroclor-specific TRVs.

LOAEL = Lowest observed adverse effects level

NOAEL = No observed adverse effects level

TCDD = Tetrachlorodibenzo-p-dioxin

mg/kg-day = Milligrams per kilogram-day



TABLE 3-2

TOXICITY REFERENCE VALUES FOR MAMMALIAN INDICATOR SPECIES  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Little Brown Bat		Muskrat <sup>a</sup>		Mink		Short-Tailed Shrew		Deer Mouse <sup>a</sup>		Red Fox	
	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)
Aroclor-1016	4.66	11.66	1.38	3.46	1.37	3.43	3.91	9.8	1.73	4.34	0.94	2.36
Aroclor-1221	0.051	0.508	0.070	0.696	0.015	0.15	0.043	0.668	0.014	0.139	0.01	0.103
Aroclor-1232	0.051	0.508	0.070	0.696	0.015	0.15	0.043	0.668	0.014	0.139	0.01	0.103
Aroclor-1242	<b>0.234</b>	<b>2.345</b>	0.070	0.696	<b>0.069</b>	<b>0.69</b>	<b>0.197</b>	<b>1.972</b>	<b>0.087</b>	<b>0.873</b>	<b>0.047</b>	<b>0.474</b>
Aroclor-1248	0.051	0.508	0.011	0.111	0.015	0.15	0.043	0.427	0.014	0.139	0.01	0.103
Aroclor-1254	0.079	0.795	0.053	0.531	0.14	0.69	0.067	0.668	0.067	0.666	0.096	0.474
Aroclor-1260	0.051	0.508	0.070	0.696	0.015	0.15	0.043	0.668	0.014	0.139	0.01	0.103
TCDD	0.0000001	0.000001	0.00000095	0.0000095	0.0000008	0.000008	0.0000022	0.000022	0.0000012	0.000012	0.0000005	0.0000053

## Notes:

a - TRVs not defined by Sample et al. (1996) (NOAELs and LOAELs derived by allometric scaling).

1) Bold Font identifies TRV defined by Sample et al. (1996). All other TRVs are the lowest of the aroclor-specific TRVs.

LOAEL = Lowest observed adverse effects level

NOAEL = No observed adverse effects level

TCDD = Tetrachlorodibenzo-p-dioxin

mg/kg-day = Milligrams per kilogram-day

TABLE 3-3

EXPOSURE CONCENTRATIONS FOR AROCLORS - NORTH-CENTRAL DEVIL'S SWAMP AOI  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

<i>Constituent of Concern</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Soil Invertebrates (mg[WW]/kg)</i>	<i>Terrestrial Plants (mg[WW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
Aroclor-1016	ND	0.0007	0.0005	0.0009	0.0026	0.0005	0.00000	0.0005
Aroclor-1221	ND	0.0009	0.0006	0.0011	0.0032	0.0007	0.00001	0.0007
Aroclor-1232	ND	0.0008	0.0005	0.0010	0.0029	0.0006	0.00001	0.0006
Aroclor-1242	ND	<b>0.0987</b>	<b>0.0063</b>	<b>0.1220</b>	<b>0.3660</b>	<b>0.0072</b>	<b>0.00006</b>	<b>0.0072</b>
Aroclor-1248	ND	0.0004	0.0003	0.0005	0.0016	0.0003	0.00000	0.0003
Aroclor-1254	ND	<b>0.0607</b>	<b>0.0030</b>	<b>0.0764</b>	0.2250	<b>0.0034</b>	<b>0.00003</b>	<b>0.0034</b>
Aroclor-1260	ND	<b>0.1569</b>	<b>0.1031</b>	<b>0.1940</b>	0.5810	<b>0.1160</b>	<b>0.00103</b>	<b>0.1160</b>

## Notes:

- 1) Bold Font identifies 95% upper confidence limit (UCL) concentration of detected aroclors. All other values are based on the midpoint of the minimum and maximum laboratory limits of detection (LODs).
  - 2) Concentrations in sediment and soil are from the 0-6 inch depth interval
  - 3) Values for invertebrates, plants, fish, and mammals are calculated using the 95% UCL concentrations in sediment and soil or of the midpoint of the minimum and maximum LODs.
- mg/L = milligrams per liter  
 mg/kg = milligrams per kilogram  
 DW = dry weight  
 WW = wet weight  
 ND = Not detected above the laboratory LOD

TABLE 3-4

**EXPOSURE CONCENTRATIONS FOR CONGENERS - AVIAN RECEPTORS - NORTH-CENTRAL DEVIL'S SWAMP AOI**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Constituent of Concern</i>	<i>TEF</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Aquatic Plants (mg[WW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Soil Invertebrates (mg[WW]/kg)</i>	<i>Terrestrial Plants (mg[WW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
PCB 105	0.0001	NA	0.000000164	0.000000029	0.00000000164	0.0000006805	0.000000034	0.000000038	0.0000000034	0.000000038
PCB 114	0.0001	NA	0.000000016	0.000000003	0.00000000016	0.0000001078	0.000000003	0.000000003	0.00000000003	0.000000003
PCB 118	0.00001	NA	0.000000115	0.000000021	0.00000000115	0.0000008829	0.000000010	0.000000011	0.00000000010	0.000000011
PCB 123	0.00001	NA	0.000000002	0.000000000	0.00000000002	0.0000000110	0.000000001	0.000000001	0.00000000001	0.000000001
PCB 126	0.1	NA	0.000007103	0.00001273	0.00000007103	0.0000319359	0.000001600	0.000001808	0.00000001600	0.000001808
PCB 156	0.0001	NA	0.000000118	0.000000021	0.00000000118	0.0000009547	0.000000030	0.000000034	0.00000000030	0.000000034
PCB 157	0.0001	NA	0.000000118	0.000000021	0.00000000118	0.0000011963	0.000000030	0.000000034	0.00000000030	0.000000034
PCB 167	0.00001	NA	0.000000005	0.000000001	0.00000000005	0.0000000280	0.000000002	0.000000002	0.00000000002	0.000000002
PCB 169	0.001	NA	0.000000009	0.000000002	0.00000000009	0.0000000451	0.000000003	0.000000004	0.00000000003	0.000000004
PCB 189	0.00001	NA	0.000000002	0.000000000	0.00000000002	0.0000000091	0.000000000	0.000000000	0.00000000000	0.000000000
PCB 77	0.05	NA	0.000030925	0.00005541	0.00000030925	0.0001904239	0.000001650	0.000001865	0.00000001650	0.000001865
PCB 81	0.01	NA	0.000001139	0.00000204	0.00000001139	0.0000019486	0.000000150	0.000000170	0.00000000150	0.000000170
<b>Sum of Congeners</b>			<b>0.000039715</b>	<b>0.00007116</b>	<b>0.00000039715</b>	<b>0.0002282239</b>	<b>0.000003512</b>	<b>0.000003969</b>	<b>0.00000003512</b>	<b>0.000003969</b>

## Notes:

1) Concentrations in sediment and soil are from the 0-6 inch sample depth interval

2) Values for invertebrates, plants, fish, and mammals are calculated using the 95% upper confidence limit (UCL) concentrations in sediment and soil or of the midpoint of the minimum and maximum laboratory limits of detection (LODs).

mg/L = milligrams per liter

mg/kg = milligrams per kilogram

TEF = Toxicity Equivalence Factor

DW = dry weight

WW = wet weight

NA = Not Analyzed

TABLE 3-5

**EXPOSURE CONCENTRATIONS FOR CONGENERS - MAMMALIAN RECEPTORS - NORTH-CENTRAL DEVIL'S SWAMP AOI**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Constituent of Concern</i>	<i>TEF</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Aquatic Plants (mg[WW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Soil Invertebrates (mg[WW]/kg)</i>	<i>Terrestrial Plants (mg[WW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
PCB 105	0.00003	NA	0.000000049	0.00000009	0.0000000049	0.0000002042	0.000000010	0.000000012	0.00000000010	0.000000012
PCB 114	0.00003	NA	0.000000005	0.00000001	0.0000000005	0.0000000323	0.000000001	0.000000001	0.00000000001	0.000000001
PCB 118	0.00003	NA	0.000000345	0.00000062	0.00000000345	0.0000026486	0.000000030	0.000000034	0.00000000030	0.000000034
PCB 123	0.00003	NA	0.000000007	0.00000001	0.00000000007	0.0000000330	0.000000002	0.000000002	0.00000000002	0.000000002
PCB 126	0.1	NA	0.000007103	0.00001273	0.00000007103	0.0000319359	0.000001600	0.000001808	0.00000001600	0.000001808
PCB 156	0.00003	NA	0.000000035	0.00000006	0.00000000035	0.0000002864	0.000000009	0.000000010	0.00000000009	0.000000010
PCB 157	0.00003	NA	0.000000035	0.00000006	0.00000000035	0.0000003589	0.000000009	0.000000010	0.00000000009	0.000000010
PCB 167	0.00003	NA	0.000000016	0.00000003	0.00000000016	0.0000000840	0.000000005	0.000000006	0.00000000005	0.000000006
PCB 169	0.03	NA	0.000000257	0.00000046	0.00000000257	0.0000013538	0.000000093	0.000000105	0.00000000093	0.000000105
PCB 189	0.00003	NA	0.000000005	0.00000001	0.00000000005	0.0000000274	0.000000001	0.000000001	0.00000000001	0.000000001
PCB 77	0.0001	NA	0.000000062	0.00000011	0.00000000062	0.0000003808	0.000000003	0.000000004	0.00000000003	0.000000004
PCB 81	0.0003	NA	0.000000003	0.00000001	0.00000000003	0.0000000058	0.000000000	0.000000001	0.00000000000	0.000000001
<b>Sum of Congeners</b>			<b>0.000007922</b>	<b>0.00001419</b>	<b>0.00000007922</b>	<b>0.0000373511</b>	<b>0.000001764</b>	<b>0.000001993</b>	<b>0.00000001764</b>	<b>0.000001993</b>

## Notes:

- 1) Concentrations in sediment and soil are from the 0-6 inch sample depth interval
  - 2) Values for invertebrates, plants, fish, and mammals are calculated using the 95% upper confidence limit (UCL) concentrations in sediment and soil or of the midpoint of the minimum and maximum laboratory limits of detection (LODs).
- mg/L = milligrams per liter  
mg/kg = milligrams per kilogram  
TEF = Toxicity Equivalence Factor  
DW = dry weight  
WW = wet weight  
NA = Not Analyzed

TABLE 3-6

EXPOSURE CONCENTRATIONS FOR AROCLORS - DRAINAGE DITCH AOI  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

<i>Constituent of Concern</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Soil Invertebrates (mg[WW]/kg)</i>	<i>Terrestrial Plants (mg[WW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
Aroclor-1016	ND	0.0024	0.0013	0.0110	0.0864	0.0015	0.00001	0.0015
Aroclor-1221	ND	0.0030	0.0017	0.0139	0.1094	0.0019	0.00002	0.0019
Aroclor-1232	ND	0.0027	0.0015	0.0126	0.0993	0.0017	0.00001	0.0017
Aroclor-1242	ND	0.0026	0.0014	0.0120	0.0943	0.0016	0.00001	0.0016
Aroclor-1248	ND	0.0015	0.0008	0.0070	0.0546	0.0009	0.00001	0.0009
Aroclor-1254	0.00016	<b>0.8182</b>	<b>1.2630</b>	<b>9.9430</b>	<b>29.8300</b>	<b>1.4280</b>	<b>0.01260</b>	<b>1.4280</b>
Aroclor-1260	0.000007	<b>0.4450</b>	<b>0.3800</b>	<b>5.3270</b>	<b>15.7400</b>	<b>0.4790</b>	<b>0.00424</b>	<b>0.4790</b>

## Notes:

- 1) Bold Font identifies 95% upper confidence limit (UCL) concentration of detected aroclors. All other values are based on the midpoint of the minimum and maximum laboratory limits of detections (LODs).
  - 2) Concentrations in sediment and soil are from the 0-6 inch sample depth interval
  - 3) Values for invertebrates, plants, fish, and mammals are calculated using the 95% UCL concentrations in sediment and soil or of the midpoint of the minimum and maximum LODs.
- mg/L = milligrams per liter  
 mg/kg = milligrams per kilogram  
 DW = dry weight  
 WW = wet weight  
 ND = Not detected above the laboratory LOD

TABLE 3-7

**EXPOSURE CONCENTRATIONS FOR CONGENERS - AVIAN RECEPTORS - DRAINAGE DITCH AOI**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Constituent of Concern</i>	<i>TEF</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Aquatic Plants (mg[WW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Soil Invertebrates (mg[WW]/kg)</i>	<i>Terrestrial Plants (mg[WW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
PCB 105	0.0001	NA	0.00000209	0.0000155	0.0000000209	0.0000007512	0.000000160	0.000000181	0.00000000160	0.000000181
PCB 114	0.0001	NA	0.00000012	0.0000009	0.0000000012	0.0000000040	0.000000004	0.000000004	0.00000000004	0.000000004
PCB 118	0.00001	NA	0.00000085	0.0000063	0.0000000085	0.0000022754	0.000000035	0.000000040	0.00000000035	0.000000040
PCB 123	0.00001	NA	0.00000001	0.0000001	0.0000000001	0.0000000002	0.000000001	0.000000001	0.00000000001	0.000000001
PCB 126	0.1	NA	0.00002625	0.0001953	0.0000002625	0.0000001286	0.000000740	0.000000836	0.00000000740	0.000000836
PCB 156	0.0001	NA	0.00000089	0.0000066	0.0000000089	0.0000002643	0.000000057	0.000000064	0.00000000057	0.000000064
PCB 157	0.0001	NA	0.00000089	0.0000066	0.0000000089	0.0000003312	0.000000057	0.000000064	0.00000000057	0.000000064
PCB 167	0.00001	NA	0.00000003	0.0000002	0.0000000003	0.0000000014	0.000000002	0.000000002	0.00000000002	0.000000002
PCB 169	0.001	NA	0.00000001	0.0000001	0.0000000001	0.0000000000	0.000000003	0.000000003	0.00000000003	0.000000003
PCB 189	0.00001	NA	0.00000000	0.0000000	0.0000000000	0.0000000000	0.000000001	0.000000001	0.00000000001	0.000000001
PCB 77	0.05	NA	0.00006292	0.0004683	0.0000006292	0.0000020248	0.000003750	0.000004238	0.00000003750	0.000004238
PCB 81	0.01	NA	0.00000200	0.0000149	0.0000000200	0.0000142084	0.000000225	0.000000254	0.00000000225	0.000000254
<b>Sum of Congeners</b>			<b>0.00009603</b>	<b>0.0007147</b>	<b>0.0000009603</b>	<b>0.0000199896</b>	<b>0.000005033</b>	<b>0.000005688</b>	<b>0.00000005033</b>	<b>0.000005688</b>

## Notes:

- 1) Concentrations in sediment and soil are from the 0-6 inch sample depth interval
  - 2) Values for invertebrates, plants, fish, and mammals are calculated using the 95% upper confidence limit (UCL) concentrations in sediment and soil or of the midpoint of the minimum and maximum limits of detection (LODs).
- mg/L = milligrams per liter  
mg/kg = milligrams per kilogram  
TEF = Toxicity Equivalence Factor  
DW = dry weight  
WW = wet weight  
NA = Not Analyzed

TABLE 3-8

**EXPOSURE CONCENTRATIONS FOR CONGENERS - MAMMALIAN RECEPTORS - DRAINAGE DITCH AOI**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Constituent of Concern</i>	<i>TEF</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Aquatic Plants (mg[WW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Soil Invertebrates (mg[WW]/kg)</i>	<i>Terrestrial Plants (mg[WW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
PCB 105	0.00003	NA	0.00000063	0.0000047	0.0000000063	0.00001080	0.000000048	0.000000054	0.0000000048	0.000000054
PCB 114	0.00003	NA	0.00000004	0.0000003	0.0000000004	0.00000101	0.000000001	0.000000001	0.0000000001	0.000000001
PCB 118	0.00003	NA	0.00000254	0.0000189	0.0000000254	0.00008078	0.000000105	0.000000119	0.00000000105	0.0000000119
PCB 123	0.00003	NA	0.00000003	0.0000002	0.0000000003	0.00000064	0.000000002	0.000000003	0.00000000002	0.000000003
PCB 126	0.1	NA	0.00002625	0.0001953	0.0000002625	0.00049013	0.000000740	0.000000836	0.00000000740	0.000000836
PCB 156	0.00003	NA	0.00000027	0.0000020	0.0000000027	0.00000895	0.000000017	0.000000019	0.00000000017	0.000000019
PCB 157	0.00003	NA	0.00000027	0.0000020	0.0000000027	0.00001122	0.000000017	0.000000019	0.00000000017	0.000000019
PCB 167	0.00003	NA	0.00000008	0.0000006	0.0000000008	0.00000168	0.000000006	0.000000006	0.00000000006	0.000000006
PCB 169	0.03	NA	0.00000029	0.0000021	0.0000000029	0.00000628	0.000000078	0.000000088	0.00000000078	0.000000088
PCB 189	0.00003	NA	0.00000001	0.0000001	0.0000000001	0.00000022	0.000000002	0.000000002	0.00000000002	0.000000002
PCB 77	0.0001	NA	0.00000013	0.0000009	0.0000000013	0.00000322	0.000000008	0.000000008	0.00000000008	0.000000008
PCB 81	0.0003	NA	0.00000001	0.0000000	0.0000000001	0.00000004	0.000000001	0.000000001	0.00000000001	0.000000001
<b>Sum of Congeners</b>			<b>0.00003051</b>	<b>0.0002271</b>	<b>0.0000003051</b>	<b>0.00061497</b>	<b>0.000001024</b>	<b>0.000001157</b>	<b>0.00000001024</b>	<b>0.000001157</b>

## Notes:

1) Concentrations in sediment and soil are from the 0-6 inch sample depth interval

2) Values for invertebrates, plants, fish, and mammals are calculated using the 95% upper confidence limit (UCL) concentrations in sediment and soil or of the midpoint of the minimum and maximum laboratory limits of detection (LODs).

mg/L = milligrams per liter

mg/kg = milligrams per kilogram

TEF = Toxicity Equivalence Factor

DW = dry weight

WW = wet weight

NA = Not Analyzed

TABLE 3-9

EXPOSURE CONCENTRATIONS FOR AROCLORS - NORTH DEVIL'S SWAMP LAKE AOI  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

<i>Constituent of Concern</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Aquatic Plants (mg[WW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
Aroclor-1016	0.000014	0.0030	0.0061	0.00003	0.0182	0.0013	0.0015
Aroclor-1221	ND	0.0038	0.0077	0.00004	0.0231	0.0016	0.0019
Aroclor-1232	ND	0.0035	0.0072	0.00004	0.0215	0.0015	0.0017
Aroclor-1242	ND	<b>0.1870</b>	<b>0.3790</b>	<b>0.00187</b>	<b>1.1380</b>	0.0062	<b>0.0070</b>
Aroclor-1248	ND	0.0019	0.0039	0.00002	0.0116	0.0008	0.0009
Aroclor-1254	ND	<b>1.6030</b>	<b>3.2510</b>	<b>0.01600</b>	<b>9.7540</b>	0.5121	<b>0.5790</b>
Aroclor-1260	ND	<b>0.1347</b>	<b>0.2730</b>	<b>0.00138</b>	<b>0.8200</b>	0.1947	<b>0.2320</b>

## Notes:

- 1) Bold Font identifies 95% upper confidence limit (UCL) concentration of detected aroclors. All other values are based on the midpoint of the minimum and maximum laboratory limits of detections ( LODs).
  - 2) Concentrations in sediment and soil are from the 0-6 inch sample depth interval
  - 3) Values for invertebrates, plants, fish, and mammals are calculated using the 95% UCL concentrations in sediment and soil or of the midpoint of the minimum and maximum laboratory LODs.
- mg/L = milligrams per liter  
 mg/kg = milligrams per kilogram  
 DW = dry weight  
 WW = wet weight  
 ND = Not detected above the laboratory LOD



TABLE 3-10

**EXPOSURE CONCENTRATIONS FOR CONGENERS - AVIAN RECEPTORS - NORTH DEVIL'S SWAMP LAKE AOI**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Constituent of Concern</i>	<i>TEF</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Aquatic Plants (mg[WW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Soil Invertebrates (mg[WW]/kg)</i>	<i>Terrestrial Plants (mg[WW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
PCB 105	0.0001	NA	0.000001313	0.000002377	0.00000001313	0.00000551	0.000000160	0.000000181	0.00000000160	0.000000181
PCB 114	0.0001	NA	0.000000079	0.000000143	0.00000000079	0.00000055	0.000000004	0.000000004	0.00000000004	0.000000004
PCB 118	0.00001	NA	0.000000455	0.000000824	0.00000000455	0.00000353	0.000000035	0.000000040	0.00000000035	0.000000040
PCB 123	0.00001	NA	0.000000008	0.000000014	0.00000000008	0.00000004	0.000000001	0.000000001	0.00000000001	0.000000001
PCB 126	0.1	NA	0.000009575	0.000017337	0.00000009575	0.00004350	0.000001600	0.000001808	0.00000001600	0.000001808
PCB 156	0.0001	NA	0.000000500	0.000000905	0.00000000500	0.00000410	0.000000057	0.000000064	0.00000000057	0.000000064
PCB 157	0.0001	NA	0.000000500	0.000000905	0.00000000500	0.00000514	0.000000057	0.000000064	0.00000000057	0.000000064
PCB 167	0.00001	NA	0.000000014	0.000000026	0.00000000014	0.00000008	0.000000002	0.000000002	0.00000000002	0.000000002
PCB 169	0.001	NA	0.000000011	0.000000019	0.00000000011	0.00000006	0.000000003	0.000000004	0.00000000003	0.000000004
PCB 189	0.00001	NA	0.000000002	0.000000004	0.00000000002	0.00000001	0.000000001	0.000000001	0.00000000001	0.000000001
PCB 77	0.05	NA	0.000042875	0.000077634	0.00000042875	0.00026678	0.000003750	0.000004238	0.00000003750	0.000004238
PCB 81	0.01	NA	0.000002449	0.000004434	0.00000002449	0.00000423	0.000000225	0.000000254	0.00000000225	0.000000254
<b>Sum of Congeners</b>			<b>0.000057780</b>	<b>0.000104622</b>	<b>0.00000057780</b>	<b>0.00033352</b>	<b>0.000005894</b>	<b>0.000006660</b>	<b>0.00000005894</b>	<b>0.000006660</b>

## Notes:

- 1) Concentrations in sediment and soil are from the 0-6 inch sample depth interval
  - 2) Values for invertebrates, plants, fish, and mammals are calculated using the 95% upper confidence limit (UCL) concentrations in sediment and soil or of the midpoint of the minimum and maximum laboratory limits of detection (LODs).
- mg/L = milligrams per liter  
mg/kg = milligrams per kilogram  
TEF = Toxicity Equivalence Factor  
DW = dry weight  
WW = wet weight  
NA = Not Analyzed

TABLE 3-11

**EXPOSURE CONCENTRATIONS FOR CONGENERS - MAMMALIAN RECEPTORS -NORTH DEVIL'S SWAMP LAKE AOI**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Constituent of Concern</i>	<i>TEF</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Aquatic Plants (mg[WW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Soil Invertebrates (mg[WW]/kg)</i>	<i>Terrestrial Plants (mg[WW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
PCB 105	0.00003	NA	0.00000039	0.00000071	0.0000000039	0.00000165	0.000000048	0.000000054	0.0000000048	0.000000054
PCB 114	0.00003	NA	0.00000002	0.00000004	0.0000000002	0.00000017	0.000000001	0.000000001	0.0000000001	0.000000001
PCB 118	0.00003	NA	0.00000137	0.00000247	0.0000000137	0.00001058	0.000000105	0.000000119	0.0000000105	0.000000119
PCB 123	0.00003	NA	0.00000002	0.00000004	0.0000000002	0.00000011	0.000000002	0.000000003	0.0000000002	0.000000003
PCB 126	0.1	NA	0.00000958	0.00001734	0.0000000958	0.00004350	0.000001600	0.000001808	0.00000001600	0.000001808
PCB 156	0.00003	NA	0.00000015	0.00000027	0.0000000015	0.00000123	0.000000017	0.000000019	0.00000000017	0.000000019
PCB 157	0.00003	NA	0.00000015	0.00000027	0.0000000015	0.00000154	0.000000017	0.000000019	0.00000000017	0.000000019
PCB 167	0.00003	NA	0.00000004	0.00000008	0.0000000004	0.00000023	0.000000006	0.000000006	0.00000000006	0.000000006
PCB 169	0.03	NA	0.00000032	0.00000057	0.0000000032	0.00000169	0.000000093	0.000000105	0.00000000093	0.000000105
PCB 189	0.00003	NA	0.00000001	0.00000001	0.0000000001	0.00000004	0.000000002	0.000000002	0.00000000002	0.000000002
PCB 77	0.0001	NA	0.00000009	0.00000016	0.0000000009	0.00000053	0.000000008	0.000000008	0.00000000008	0.000000008
PCB 81	0.0003	NA	0.00000001	0.00000001	0.0000000001	0.00000001	0.000000001	0.000000001	0.00000000001	0.000000001
<b>Sum of Congeners</b>			<b>0.00001214</b>	<b>0.00002198</b>	<b>0.0000001214</b>	<b>0.00006129</b>	<b>0.000001899</b>	<b>0.000002146</b>	<b>0.00000001899</b>	<b>0.000002146</b>

## Notes:

- 1) Concentrations in sediment and soil are from the 0-6 inch sample depth interval
  - 2) Values for invertebrates, plants, fish, and mammals are calculated using the 95% upper confidence limit (UCL) concentrations in sediment and soil or of the midpoint of the minimum and maximum laboratory limits of detection (LODs).
- mg/L = milligrams per liter  
mg/kg = milligrams per kilogram  
TEF = Toxicity Equivalence Factor  
DW = dry weight  
WW = wet weight  
NA = Not Analyzed

TABLE 3-12

EXPOSURE CONCENTRATIONS FOR AROCLORS - SOUTH DEVIL'S SWAMP LAKE AOI  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

<i>Constituent of Concern</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Aquatic Plants (mg[WW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
Aroclor-1016	ND	0.0008	0.0011	0.00001	0.00129	0.0032	0.0015
Aroclor-1221	ND	0.0010	0.0014	0.00001	0.00165	0.0042	0.0019
Aroclor-1232	ND	<b>0.0009</b>	<b>0.0012</b>	<b>0.00001</b>	0.00147	<b>0.0037</b>	<b>0.0017</b>
Aroclor-1242	ND	0.0356	0.0253	0.00017	0.00623	0.0687	0.0070
Aroclor-1248	ND	0.0005	0.0007	0.00001	0.00082	0.0021	0.0009
Aroclor-1254	ND	<b>0.1680</b>	<b>0.2300</b>	<b>0.00168</b>	0.51210	<b>0.6890</b>	<b>0.5790</b>
Aroclor-1260	ND	<b>0.0422</b>	<b>0.0553</b>	<b>0.00034</b>	0.19470	<b>0.1660</b>	<b>0.2320</b>

## Notes:

- 1) Bold Font identifies 95% upper confidence limit (UCL) concentration of detected aroclors. All other values are based on the midpoint of the minimum and maximum laboratory limits of detections ( LODs).
  - 2) Concentrations in sediment and soil are from the 0-6 inch sample depth interval.
  - 3) Values for invertebrates, plants, fish, and mammals are calculated using the 95% UCL concentrations in sediment and soil or of the midpoint of the minimum and maximum laboratory LODs.
- mg/L = milligrams per liter  
 mg/kg = milligrams per kilogram  
 DW = dry weight  
 WW = wet weight  
 ND = Not detected above the laboratory LOD

TABLE 3-13

**EXPOSURE CONCENTRATIONS FOR CONGENERS - AVIAN RECEPTORS - SOUTH DEVIL'S SWAMP LAKE AOI**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Constituent of Concern</i>	<i>TEF</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Aquatic Plants (mg[WW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Soil Invertebrates (mg[WW]/kg)</i>	<i>Terrestrial Plants (mg[WW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
PCB 105	0.0001	NA	0.000000263	0.000000453	0.00000000263	0.00000105	0.000000160	0.000000181	0.00000000160	0.000000181
PCB 114	0.0001	NA	0.000000017	0.000000030	0.00000000017	0.00000011	0.000000004	0.000000004	0.00000000004	0.000000004
PCB 118	0.00001	NA	0.000000153	0.000000264	0.00000000153	0.00000113	0.000000035	0.000000396	0.00000000035	0.000000040
PCB 123	0.00001	NA	0.000000002	0.000000003	0.00000000002	0.00000001	0.000000001	0.000000009	0.00000000001	0.000000001
PCB 126	0.1	NA	0.000007067	0.000012158	0.00000007067	0.00003051	0.000001600	0.000000002	0.00000001600	0.000001808
PCB 156	0.0001	NA	0.000000140	0.000000240	0.00000000140	0.00000109	0.000000057	0.000000064	0.00000000057	0.000000064
PCB 157	0.0001	NA	0.000000140	0.000000240	0.00000000140	0.00000136	0.000000057	0.000000064	0.00000000057	0.000000064
PCB 167	0.00001	NA	0.000000005	0.000000008	0.00000000005	0.00000002	0.000000002	0.000000021	0.00000000002	0.000000002
PCB 169	0.001	NA	0.000000003	0.000000006	0.00000000003	0.00000002	0.000000003	0.000000000	0.00000000003	0.000000004
PCB 189	0.00001	NA	0.000000001	0.000000001	0.00000000001	0.00000000	0.000000001	0.000000006	0.00000000001	0.000000001
PCB 77	0.05	NA	0.000022500	0.000038712	0.00000022500	0.00013303	0.000003750	0.000000008	0.00000003750	0.000004238
PCB 81	0.01	NA	0.000001490	0.000002564	0.00000001490	0.00000245	0.000000225	0.000000000	0.00000000225	0.000000254
<b>Sum of Congeners</b>			<b>0.000031781</b>	<b>0.000054680</b>	<b>0.00000031781</b>	<b>0.00017078</b>	<b>0.000005894</b>	<b>0.000000756</b>	<b>0.00000005894</b>	<b>0.000006660</b>

## Notes:

- 1) Concentrations in sediment and soil are from the 0-6 inch sample depth interval
  - 2) Values for invertebrates, plants, fish, and mammals are calculated using the 95% upper confidence limit (UCL) concentrations in sediment and soil or of the midpoint of the minimum and maximum laboratory limits of detection (LODs).
- mg/L = milligrams per liter  
mg/kg = milligrams per kilogram  
TEF = Toxicity Equivalence Factor  
DW = dry weight  
WW = wet weight  
NA = Not Analyzed

TABLE 3-14

**EXPOSURE CONCENTRATIONS FOR CONGENERS - MAMMALIAN RECEPTORS -SOUTH DEVIL'S SWAMP LAKE AOI**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Constituent of Concern</i>	<i>TEF</i>	<i>Surface Water (mg/L)</i>	<i>Sediment (mg[DW]/kg)</i>	<i>Benthic Invertebrates (mg[WW]/kg)</i>	<i>Aquatic Plants (mg[WW]/kg)</i>	<i>Fish (mg[WW]/kg)</i>	<i>Soil (mg[DW]/kg)</i>	<i>Soil Invertebrates (mg[WW]/kg)</i>	<i>Terrestrial Plants (mg[WW]/kg)</i>	<i>Terrestrial Mammals (mg[WW]/kg)</i>
PCB 105	0.00003	NA	0.00000008	0.00000014	0.0000000008	0.000000032	0.000000048	0.000000054	0.00000000048	0.000000054
PCB 114	0.00003	NA	0.00000001	0.00000001	0.0000000001	0.00000003	0.000000001	0.000000001	0.00000000001	0.000000001
PCB 118	0.00003	NA	0.00000046	0.00000079	0.0000000046	0.00000339	0.000000105	0.000000119	0.00000000105	0.000000119
PCB 123	0.00003	NA	0.00000001	0.00000001	0.0000000001	0.00000003	0.000000002	0.000000003	0.00000000002	0.000000003
PCB 126	0.1	NA	0.00000707	0.00001216	0.0000000707	0.00003051	0.000001600	0.000001808	0.00000001600	0.000001808
PCB 156	0.00003	NA	0.00000004	0.00000007	0.0000000004	0.00000033	0.000000017	0.000000019	0.00000000017	0.000000019
PCB 157	0.00003	NA	0.00000004	0.00000007	0.0000000004	0.00000041	0.000000017	0.000000019	0.00000000017	0.000000019
PCB 167	0.00003	NA	0.00000001	0.00000002	0.0000000001	0.00000007	0.000000006	0.000000006	0.00000000006	0.000000006
PCB 169	0.03	NA	0.00000010	0.00000017	0.0000000010	0.00000050	0.000000093	0.000000105	0.00000000093	0.000000105
PCB 189	0.00003	NA	0.00000000	0.00000000	0.0000000000	0.00000001	0.000000002	0.000000002	0.00000000002	0.000000002
PCB 77	0.0001	NA	0.00000005	0.00000008	0.0000000005	0.00000027	0.000000008	0.000000008	0.00000000008	0.000000008
PCB 81	0.0003	NA	0.00000000	0.00000001	0.0000000000	0.00000001	0.000000001	0.000000001	0.00000000001	0.000000001
<b>Sum of Congeners</b>			<b>0.00000786</b>	<b>0.00001353</b>	<b>0.0000000786</b>	<b>0.00003586</b>	<b>0.000001899</b>	<b>0.000002146</b>	<b>0.00000001899</b>	<b>0.000002146</b>

## Notes:

1) Concentrations in sediment and soil are from the 0-6 inch sample depth interval

2) Values for invertebrates, plants, fish, and mammals are calculated using the 95% upper confidence limit (UCL) concentrations in sediment and soil or of the midpoint of the minimum and maximum laboratory limits of detection (LODs).

mg/L = milligrams per liter

mg/kg = milligrams per kilogram

TEF = Toxicity Equivalence Factor

DW = dry weight

WW = wet weight

NA = Not Analyzed

**TABLE 3-15**  
**EXPOSURE FACTORS FOR AVIAN RECEPTORS**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Factor</i>	<i>Units</i>	<i>Sediment Exposure</i>			<i>Soil Exposure</i>		
		<i>Green Heron Insectivore</i>	<i>Belted Kingfisher Piscivore</i>	<i>Bald Eagle Piscivore</i>	<i>American Woodcock Insectivore</i>	<i>Northern Bobwhite Herbivore</i>	<i>Red-Tailed Hawk Carnivore</i>
<i>Body Mass</i>	kg	0.23	0.15	3.75	0.18	0.19	1.13
<i>IR<sub>Food</sub></i>	kg(WW)/kg-day	0.81	0.56	0.11	0.56	0.87	0.17
<i>IR<sub>Water</sub></i>	L/kg-day	0.096	0.11	0.037	0.11	0.10	0.057
<i>IR<sub>Sediment</sub></i>							
Percent	%	9.4	5.9	5.9	10.4	9.3	1.0
Rate	kg(DW)/kg-day	0.0091	0.0067	0.0022	0.011	0.010	0.0006
<i>Diet</i>							
Aquatic Insects	%	55	0	0	0	0	0
Aquatic Plants	%	0	0	0	0	0	0
Fish	%	40	80	74	0	0	0
Soil Invertebrates	%	0	20	0	100	10	10
Terrestrial Plants	%	0	0	0	0	90	0
Small Terrestrial Mammals	%	5	0	26	0	0	90
<i>Area Use</i>							
Foraging Range	Hectares	4.5	4.5	1,855	86	11	1,263
Diet from NCDS	%	100	---	0.81	5.8	45	0.4
Diet from DD	%	10	10	---	0.54	4.2	0.04
Diet from NDSL	%	100	---	0.27	---	---	---
Diet from SDSL	%	100	---	0.22	---	---	---
<i>Bioavailability</i>	%	100	100	100	100	100	100

## Notes:

NCDS = North-Central Devil's Swamp

DD = Drainage Ditch

NDSL = North Devil's Swamp Lake

SDSL = South Devil's Swamp Lake

kg = kilograms

mg/kg-day = Milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

IR = Ingestion Rate

TABLE 3-16  
EXPOSURE FACTORS FOR MAMMALIAN RECEPTORS  
STEP 3 - PROBLEM FORMULATION  
DEVIL'S SWAMP LAKE SITE  
EAST BATON ROUGE PARISH, LOUISIANA

<i>Factor</i>	<i>Units</i>	<i>Sediment Exposure</i>			<i>Soil Exposure</i>		
		<i>Little Brown Bat Insectivore</i>	<i>Muskrat Herbivore</i>	<i>Mink Piscivore</i>	<i>Short-Tailed Shrew Insectivore</i>	<i>Deer Mouse Herbivore</i>	<i>Red Fox Carnivore</i>
<i>Body Mass</i>	kg	0.01	0.87	0.99	0.02	0.02	4.53
$IR_{Food}$	kg(WW)/kg-day	0.821	0.76	0.22	0.73	2.12	0.16
$IR_{Water}$	L/kg-day	0.140	0.10	0.099	0.18	0.15	0.086
$IR_{Sediment}$							
Percent	%	0.0	3.3	9.4	1.0	2.0	2.8
Rate	kg(DW)/kg-day	0.000	0.003	0.006	0.001	0.005	0.001
<i>Diet</i>							
Aquatic Insects	%	100	92	0	0	0	0
Aquatic Plants	%	0	8	0	0	0	0
Fish	%	0	0	90	0	0	0
Soi Invertebrates	%	0	0	0	85	7	0
Terrestrial Plants	%	0	0	0	10	93	10
Small Terrestrial Mammals	%	0	0	10	5	0	90
<i>Area Use</i>							
Foraging Range	Hectares	0.25	0.11	3,931	0.92	0.071	1,739
Diet from NCDS	%	100	---	0.38	100	100	0.29
Diet from DD	%	100	---	0.01	51	100	0.03
Diet from NDSL	%	100	100	0.13	---	---	---
Diet from SDSL	%	100	---	0.10	---	---	---
<i>Bioavailability</i>	%	100	100	100	100	100	100

## Notes:

NCDS = North-Central Devil's Swamp

DD = Drainage Ditch

NDSL = North Devil's Swamp Lake

SDSL = South Devil's Swamp Lake

kg = kilograms

mg/kg-day = Milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

IR = Ingestion Rate

TABLE 4-1

REFINEMENT OF RISK TO BENTHIC INVERTEBRATES - NORTH-CENTRAL DEVIL'S SWAMP AOI  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

<i>Parameter</i>	<i>Value</i>	<i>Consensus Benchmarks</i>		
		<i>TEC</i>	<i>PEC</i>	<i>Mid-Point</i>
<i>Ecological Benchmark - Total Aroclors (ug/kg)</i>		59.8	676	368
<i>Maximum Detected Concentration - Total Aroclors (ug/kg)</i>	369			
No. of Samples Exceeding Benchmark		5	0	1
Percent of Samples Exceeding Benchmark		33%	0%	6.7%

## Notes:

PEC = Probable effects concentration  
 TEC = Threshold effects concentration  
 ug/kg = micrograms per kilogram



TABLE 4-2

**FOOD CHAIN RESULTS FOR GREEN HERON - NORTH-CENTRAL DEVIL'S SWAMP AOI - SEDIMENT**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Constituent of Concern	Ingestion						NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Benthic Invertebrates (mg [WW]/kg-day)	Fish (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.0004	0.0008	0.00002	0	0.000006	0.0012	0.18	0.007	---	0.36	0.0034	---
Aroclor-1221	0.0005	0.0010	0.00003	0	0.000008	0.0016	0.180	0.009	---	0.36	0.0043	---
Aroclor-1232	0.0004	0.0009	0.00003	0	0.000007	0.0014	0.180	0.008	---	0.36	0.0038	---
Aroclor-1242	0.0543	0.1185	0.00029	0	0.000901	0.1740	0.410	0.424	---	0.36	0.4833	---
Aroclor-1248	0.0002	0.0005	0.00001	0	0.000004	0.0008	0.180	0.004	---	0.36	0.0021	---
Aroclor-1254	0.0340	0.0728	0.00014	0	0.000554	0.1075	0.180	0.597	---	1.8	0.0597	---
Aroclor-1260	0.0864	0.1881	0.00469	0	0.001432	0.2806	0.180	<b>1.56</b>	---	0.36	0.7794	---
								---	<b>2.61</b>		---	<b>1.34</b>
						AUF	1	---	<b>2.61</b>		---	<b>1.34</b>
PCB Congener	0.000032	0.000074	0.00000016	0	0.00000036	0.00011	0.000014	---	<b>7.58</b>	0.00014	---	0.758
						AUF	1	---	<b>7.58</b>		---	0.758

## Notes:

Bold Font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-3

FOOD CHAIN RESULTS FOR LITTLE BROWN BAT - NORTH-CENTRAL DEVIL'S SWAMP AOI - SEDIMENT  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion				NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Soil Invertebrates (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.00070	0	0	0.0007	4.66	0.000	---	11.66	0.000	---
Aroclor-1221	0.00088	0	0	0.0009	0.051	0.017	---	0.508	0.002	---
Aroclor-1232	0.00078	0	0	0.0008	0.051	0.015	---	0.508	0.002	---
Aroclor-1242	0.10016	0	0	0.1002	0.234	0.428	---	2.345	0.043	---
Aroclor-1248	0.00043	0	0	0.0004	0.051	0.008	---	0.508	0.001	---
Aroclor-1254	0.06272	0	0	0.0627	0.079	0.794	---	0.795	0.079	---
Aroclor-1260	0.15926	0	0	0.1593	0.051	<b>3.12</b>	---	0.508	0.314	---
						---	<b>4.39</b>		---	0.439
				AUF	1	---	<b>4.39</b>		---	0.439
PCB Congeners	0.000012	0	0	0.000012	0.0000001	---	117	0.000001	---	11.7
				AUF	1	---	117		---	11.7

## Notes:

Bold Font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

**TABLE 4-4**  
**FOOD CHAIN RESULTS FOR BALD EAGLE - NORTH-CENTRAL DEVIL'S SWAMP AOI - SEDIMENT**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sup>NOAEL</sup> (Unitless)	HI <sup>NOAEL</sup> (Unitless)
	Fish (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)			
Aroclor-1016	0.0002	0.00002	0	0.000001	0.0002	0.18	0.001	---
Aroclor-1221	0.0003	0.00002	0	0.000002	0.0003	0.180	0.002	---
Aroclor-1232	0.0002	0.00002	0	0.000002	0.0003	0.180	0.001	---
Aroclor-1242	0.0310	0.00021	0	0.000214	0.0315	0.410	0.077	---
Aroclor-1248	0.0001	0.00001	0	0.000001	0.0001	0.180	0.001	---
Aroclor-1254	0.0191	0.00010	0	0.000131	0.0193	0.180	0.107	---
Aroclor-1260	0.0493	0.00346	0	0.000339	0.0531	0.180	0.295	---
							---	0.484
					AUF	0.0081	---	0.0039
PCB Congeners	0.000028	0.0000002	0	0.00000012	0.000029	0.000014	---	2.04
					AUF	0.0081	---	0.017

## Notes:

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-5

FOOD CHAIN RESULTS FOR MINK - NORTH-CENTRAL DEVIL'S SWAMP AOI - SEDIMENT  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Fish (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.0005	0.00001	0	0.00000	0.0005	1.37	0.0004	---	3.43	0.0001	---
Aroclor-1221	0.0006	0.00001	0	0.00001	0.0006	0.015	0.043	---	0.15	0.004	---
Aroclor-1232	0.0006	0.00001	0	0.00000	0.0006	0.015	0.038	---	0.15	0.004	---
Aroclor-1242	0.0709	0.00015	0	0.00064	0.0717	0.069	1.038	---	0.69	0.104	---
Aroclor-1248	0.0003	0.00001	0	0.00000	0.0003	0.015	0.021	---	0.15	0.002	---
Aroclor-1254	0.0436	0.00007	0	0.00039	0.0440	0.140	0.314	---	0.69	0.064	---
Aroclor-1260	0.1125	0.00250	0	0.00102	0.1160	0.015	7.73	---	0.15	0.773	---
							---	9.19		---	0.951
					AUF	0.0038	---	0.035		---	0.004
PCB Congeners	0.000007	0.0000000	0	0.000000051	0.000007	0.0000008	---	9.16	0.000008	---	0.916
					AUF	0.0038	---	0.035		---	0.003

## Notes:

Bold Font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-6

REFINEMENT OF SURFACE WATER - DRAINAGE DITCH AOI  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

<i>Parameter</i>	<i>Value</i>	<i>Fish</i>				<i>Aquatic Plants</i>
		<i>EC<sub>20</sub></i>	<i>EC<sub>25</sub> Bass</i>	<i>LCV</i>	<i>Geometric Mean of Fish Benchmarks</i>	<i>LCV</i>
<i>Ecological Benchmark - Total Aroclors (ug/L)</i>		0.4	0.63	0.2	0.369	0.144
<i>Maximum Detected Concentration - Total Aroclors (ug/L)</i>	0.22					
No. of Samples Exceeding Benchmark		0	0	1	0	1
Percent of Samples Exceeding Benchmark		0%	0%	8.3%	0%	8.3%
<i>95% Upper Confidence Limit - Total Aroclors (ug/L)</i>	0.162					
95% UCL Exceeds Benchmark		No	No	No	No	<b>YES</b>
<i>Arithmetic Mean (ug/L)</i>	0.092					
Arithmetic Mean Exceeds Benchmark		No	No	No	No	No
<i>Median - Total Aroclors (ug/L)</i>	0.098					
Median Exceeds Benchmark		No	No	No	No	No
<i>Geometric Mean - Total Aroclors (ug/L)</i>	0.063					
Geometric Mean Exceeds Benchmark		No	No	No	No	No

## Notes:

EC<sub>20</sub> = 20% effects concentrationEC<sub>25</sub> = 25% effects concentration

LCV = Lowest chronic value

UCL = Upper Confidence Limit

ug/L = micrograms per Liter

TABLE 4-7

REFINEMENT OF RISK TO BENTHIC INVERTEBRATES - DRAINAGE DITCH AOI  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

<i>Parameter</i>	<i>Value</i>	<i>Consensus Benchmarks</i>		
		<i>TEC</i>	<i>PEC</i>	<i>Mid-Point</i>
<i>Ecological Benchmark - Total Aroclors (ug/kg)</i>		59.8	676	368
<i>Maximum Detected Concentration - Total Aroclors (ug/kg)</i>	1,990			
No. of Samples Exceeding Benchmark		9	6	7
Percent of Samples Exceeding Benchmark		75%	50%	58%

## Notes:

PEC = Probable effects concentration

TEC = Threshold effects concentration

ug/kg = Micrograms per kilogram

TABLE 4-8

FOOD CHAIN RESULTS FOR GREEN HERON - DRAINAGE DITCH AOI - SEDIMENT  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion						NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Benthic Invertebrates (mg [WW]/kg-day)	Fish (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.005	0.028	0.00006	0	0.00002	0.033	0.18	0.183	---	0.36	0.0915	---
Aroclor-1221	0.006	0.035	0.00008	0	0.00003	0.042	0.180	0.232	---	0.36	0.1159	---
Aroclor-1232	0.006	0.032	0.00007	0	0.00002	0.038	0.180	0.210	---	0.36	0.1052	---
Aroclor-1242	0.005	0.031	0.00006	0	0.00002	0.036	0.410	0.088	---	0.36	0.0999	---
Aroclor-1248	0.003	0.018	0.00004	0	0.00001	0.021	0.180	0.116	---	0.36	0.0578	---
Aroclor-1254	4.426	9.657	0.05779	0	0.00747	14.149	0.180	<b>78.6</b>	---	1.8	<b>7.86</b>	---
Aroclor-1260	2.371	5.096	0.01938	0	0.00406	7.491	0.180	<b>41.6</b>	---	0.36	<b>20.8</b>	---
								---	<b>121</b>		---	<b>29.1</b>
						AUF	0.1	---	<b>12.1</b>		---	<b>2.91</b>
PCB Congene	0.00032	0.000006	0.000000047	0	0.00000088	0.00033	0.000014	---	<b>23.3</b>	0.00014	---	<b>2.33</b>
						AUF	0.1	---	<b>2.33</b>		---	<b>0.233</b>

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-9

**FOOD CHAIN RESULTS FOR LITTLE BROWN BAT - DRAINAGE DITCH AOI - SEDIMENT**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Constituent of Concern	Ingestion				NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Soil Invertebrates (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.00899	0	0	0.0090	4.66	0.002	---	11.66	0.001	---
Aroclor-1221	0.01143	0	0	0.0114	0.051	0.224	---	0.508	0.023	---
Aroclor-1232	0.01033	0	0	0.0103	0.051	0.203	---	0.508	0.020	---
Aroclor-1242	0.00982	0	0	0.0098	0.234	0.042	---	2.345	0.004	---
Aroclor-1248	0.00571	0	0	0.0057	0.051	0.112	---	0.508	0.011	---
Aroclor-1254	8.16266	0.000022	0	8.1627	0.079	<b>103</b>	---	0.795	<b>10.3</b>	---
Aroclor-1260	4.37318	0.000001	0	4.3732	0.051	<b>85.7</b>	---	0.508	<b>8.61</b>	---
						---	<b>190</b>		---	<b>18.9</b>
				AUF	1	---	<b>190</b>		---	<b>18.9</b>
PCB Congeners	0.00019	0	0	0.00019	0.0000001	---	<b>1,864</b>	0.000001	---	<b>186</b>
				AUF	1	---	<b>1,864</b>		---	<b>186</b>

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight



TABLE 4-10

**FOOD CHAIN RESULTS FOR BELTED KINGFISHER - DRAINAGE DITCH AOI - SEDIMENT**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Constituent of Concern</i>	<i>Ingestion</i>					<i>NOAEL (mg/kg-day)</i>	<i>HQ<sub>NOAEL</sub> (Unitless)</i>	<i>HI<sub>NOAEL</sub> (Unitless)</i>	<i>LOAEL (mg/kg-day)</i>	<i>HQ<sub>LOAEL</sub> (Unitless)</i>	<i>HI<sub>LOAEL</sub> (Unitless)</i>
	<i>Fish (mg [WW]/kg-day)</i>	<i>Soil Invertebrates (mg [WW]/kg-day)</i>	<i>Water (mg/kg-day)</i>	<i>Sediment (mg [DW]/kg-day)</i>	<i>Total (mg/kg-day)</i>						
Aroclor-1016	0.0244	0.00005	0	0.000016	0.0244	0.18	0.136	---	0.36	0.068	---
Aroclor-1221	0.0308	0.00007	0	0.000020	0.0309	0.180	0.172	---	0.36	0.086	---
Aroclor-1232	0.0280	0.00006	0	0.000018	0.0281	0.180	0.156	---	0.36	0.078	---
Aroclor-1242	0.0266	0.00006	0	0.000017	0.0267	0.410	0.065	---	0.36	0.074	---
Aroclor-1248	0.0154	0.00003	0	0.000010	0.0154	0.180	0.086	---	0.36	0.043	---
Aroclor-1254	8.4084	0.10063	0.000017	0.005443	8.5145	0.180	<b>47.3</b>	---	1.8	<b>4.73</b>	---
Aroclor-1260	5.5459	0.03375	0.0000007	0.002960	5.5826	0.180	<b>31.0</b>	---	0.36	<b>15.5</b>	---
							---	<b>78.9</b>		---	<b>20.6</b>
					AUF	0.1	---	<b>7.89</b>		---	<b>2.06</b>
PCB Congeners	0.0000056	0.0000004	0	0.00000064	0.0000067	0.000014	---	0.477	0.00014	---	0.048
					AUF	0.1	---	0.048		---	0.0048

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-11

FOOD CHAIN RESULTS FOR MINK - DRAINAGE DITCH AOI - SEDIMENT  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Fish (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.0167	0.00003	0	0.00002	0.0168	1.37	0.0122	---	3.43	0.0049	---
Aroclor-1221	0.0212	0.00004	0	0.00002	0.0212	0.015	1.416	---	0.15	0.1416	---
Aroclor-1232	0.0192	0.00004	0	0.00002	0.0193	0.015	1.286	---	0.15	0.1286	---
Aroclor-1242	0.0183	0.00003	0	0.00002	0.0183	0.069	0.265	---	0.69	0.0265	---
Aroclor-1248	0.0106	0.00002	0	0.00001	0.0106	0.015	0.707	---	0.15	0.0707	---
Aroclor-1254	5.7755	0.03072	0.000016	0.00529	5.8115	0.140	41.5	---	0.69	<b>8.42</b>	---
Aroclor-1260	3.0475	0.01030	0.0000007	0.00288	3.0607	0.015	<b>204</b>	---	0.15	<b>20.4</b>	---
							---	<b>249</b>		---	<b>29.2</b>
					AUF	0.0001	---	0.025		---	0.003
PCB Congeners	0.000119	0.0000000	0	0.000000197	0.000119	0.0000008	---	<b>149</b>	0.000008	---	<b>14.9</b>
					AUF	0.0001	---	0.015		---	0.001

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-12

FOOD CHAIN RESULTS FOR AMERICAN WOODCOCK - DRAINAGE DITCH AOI - SOIL  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion				NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Soil Invertebrates (mg [WW]/kg-day)	Water (mg/kg-day)	Soil (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.00081	0	0.000014	0.0008	0.18	0.005	---	0.36	0.002	---
Aroclor-1221	0.00104	0	0.000018	0.0011	0.180	0.006	---	0.36	0.003	---
Aroclor-1232	0.00093	0	0.000016	0.0009	0.180	0.005	---	0.36	0.003	---
Aroclor-1242	0.00089	0	0.000016	0.0009	0.410	0.002	---	0.36	0.003	---
Aroclor-1248	0.00052	0	0.000009	0.0005	0.180	0.003	---	0.36	0.001	---
Aroclor-1254	0.79517	0.000017	0.013897	0.8091	0.180	<b>4.49</b>	---	1.8	0.449	---
Aroclor-1260	0.26673	0.0000007	0.004181	0.2709	0.180	<b>1.51</b>	---	0.36	0.753	---
						---	<b>6.02</b>		---	<b>1.21</b>
				AUF	0.0054	---	0.033		---	0.007
PCB Congeners	0.0000032	0	0.000000055	0.0000032	0.000014	---	0.230	0.00014	---	0.023
				AUF	0.0054	---	0.001		---	0.0001

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-13

**FOOD CHAIN RESULTS FOR SHORT-TAILED SHREW - DRAINAGE DITCH AOI - SOIL**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Constituent of Concern	Ingestion						NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Soil Invertebrates (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Terrestrial Plants (mg [WW]/kg-day)	Water (mg/kg-day)	Soil (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.0009	0.0001	0.00000	0	0.000002	0.0010	3.91	0.000	---	9.8	0.0001	---
Aroclor-1221	0.0012	0.0001	0.00000	0	0.000002	0.0012	0.043	0.028	---	0.668	0.0018	---
Aroclor-1232	0.0010	0.0001	0.00000	0	0.000002	0.0011	0.043	0.025	---	0.668	0.0016	---
Aroclor-1242	0.0010	0.0001	0.00000	0	0.000002	0.0010	0.197	0.005	---	1.972	0.0005	---
Aroclor-1248	0.0006	0.0000	0.00000	0	0.000001	0.0006	0.043	0.014	---	0.427	0.0014	---
Aroclor-1254	0.8808	0.0518	0.00091	0.000028	0.001741	0.9353	0.067	<b>14.0</b>	---	0.668	1.4001	---
Aroclor-1260	0.2955	0.0174	0.00031	0.0000012	0.000524	0.3137	0.043	<b>7.29</b>	---	0.668	0.4696	---
								---	<b>21.3</b>		---	<b>1.88</b>
						AUF	0.51	---	<b>10.9</b>		---	0.956
PCB Congeners	0.00000071	0.000000042	0.00000000074	0	0.0000000014	0.00000	0.0000022	---	0.344	0.000022	---	0.034
						AUF	0.51	---	0.176		---	0.018

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-14

FOOD CHAIN RESULTS FOR NORTHERN BOBWHITE - DRAINAGE DITCH AOI - SOIL  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Soil Invertebrates (mg [WW]/kg-day)	Terrestrial Plants (mg [WW]/kg-day)	Water (mg/kg-day)	Soil (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.0001	0.00001	0	0.000013	0.0001	0.18	0.000	---	0.36	0.000	---
Aroclor-1221	0.0001	0.00001	0	0.000016	0.0001	0.180	0.001	---	0.36	0.000	---
Aroclor-1232	0.0001	0.00001	0	0.000014	0.0001	0.180	0.001	---	0.36	0.000	---
Aroclor-1242	0.0001	0.00001	0	0.000014	0.0001	0.410	0.000	---	0.36	0.000	---
Aroclor-1248	0.0000	0.00001	0	0.000008	0.0001	0.180	0.000	---	0.36	0.000	---
Aroclor-1254	0.1235	0.00981	0.000016	0.012195	0.1456	0.180	0.809	---	1.8	0.081	---
Aroclor-1260	0.0414	0.00330	0.0000007	0.003669	0.0484	0.180	0.269	---	0.36	0.134	---
							---	<b>1.08</b>		---	0.217
					AUF	0.042	---	0.045		---	0.009
PCB Congeners	0.00000049	0.000000039	0	0.000000049	0.00000058	0.000014	---	0.041	0.00014	---	0.004
					AUF	0.042	---	0.002		---	0.0002

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-15

**FOOD CHAIN RESULTS FOR DEER MOUSE - DRAINAGE DITCH AOI - SEDIMENT**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Soil Invertebrates (mg [WW]/kg-day)	Terrestrial Plants (mg[WW]/kg-day)	Water (mg/kg-day)	Soil (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.00022	0.00003	0	0.000007	0.00025	1.73	0.000	---	4.34	0.000	---
Aroclor-1221	0.00028	0.00003	0	0.000008	0.00032	0.014	0.023	---	0.14	0.002	---
Aroclor-1232	0.00025	0.00003	0	0.000008	0.00028	0.014	0.020	---	0.14	0.002	---
Aroclor-1242	0.00024	0.00003	0	0.000007	0.00027	0.087	0.003	---	0.87	0.000	---
Aroclor-1248	0.00014	0.00002	0	0.000004	0.00016	0.014	0.011	---	0.14	0.001	---
Aroclor-1254	0.21215	0.02487	0.000023	0.006433	0.24347	0.067	<b>3.66</b>	---	0.67	0.366	---
Aroclor-1260	0.07116	0.00837	0.000001	0.001936	0.08147	0.014	<b>5.85</b>	---	0.14	0.585	---
							---	9.57		---	0.957
					AUF	1	---	9.57		---	0.957
PCB Congeners	0.00000017	0.000000020	0	0.0000000052	0.00000020	0.0000012	---	0.166	0.000012	---	0.017
					AUF	1	---	0.166		---	0.017

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-16

FOOD CHAIN RESULTS FOR RED-TAILED HAWK - DRAINAGE DITCH AOI - SOIL  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Terrestrial Mammals (mg [WW]/kg-day)	Soil Invertebrates (mg [WW]/kg-day)	Water (mg/kg-day)	Soil (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.0002	0.00001	0	0.000001	0.0002	0.18	0.001	---	0.36	0.001	---
Aroclor-1221	0.0003	0.00002	0	0.000001	0.0003	0.180	0.002	---	0.36	0.001	---
Aroclor-1232	0.0003	0.00002	0	0.000001	0.0003	0.180	0.002	---	0.36	0.001	---
Aroclor-1242	0.0003	0.00001	0	0.000001	0.0003	0.410	0.001	---	0.36	0.001	---
Aroclor-1248	0.0001	0.00001	0	0.000000	0.0002	0.180	0.001	---	0.36	0.000	---
Aroclor-1254	0.2238	0.02487	0.000009	0.000704	0.2494	0.180	<b>1.39</b>	---	1.8	0.139	---
Aroclor-1260	0.0751	0.00834	0.00000039	0.000212	0.0836	0.180	0.465	---	0.36	0.232	---
							---	<b>1.86</b>		---	0.374
					AUF	0.0004	---	0.0007		---	0.0001
PCB Congeners	0.00000089	0.000000099	0	0.0000000028	0.00000099	0.000014	---	0.071	0.00014	---	0.007
					AUF	0.0004	---	0.00003		---	0.000003

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-17

**FOOD CHAIN RESULTS FOR RED FOX - DRAINAGE DITCH AOI - SEDIMENT**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Terrestrial Mammals (mg [WW]/kg-day)	Terrestrial Plants (mg[WW]/kg-day)	Water (mg/kg-day)	Soil (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.00022	0.0000002	0	0.000002	0.000218	0.94	0.000	---	2.36	0.000	---
Aroclor-1221	0.00028	0.0000003	0	0.000002	0.000278	0.010	0.028	---	0.10	0.003	---
Aroclor-1232	0.00025	0.0000002	0	0.000002	0.000249	0.010	0.025	---	0.10	0.002	---
Aroclor-1242	0.00024	0.0000002	0	0.000002	0.000238	0.047	0.005	---	0.47	0.001	---
Aroclor-1248	0.00014	0.0000001	0	0.000001	0.000139	0.010	0.014	---	0.10	0.001	---
Aroclor-1254	0.21091	0.0002068	0.000014	0.001857	0.212990	0.096	<b>2.22</b>	---	0.47	0.449	---
Aroclor-1260	0.07075	0.0000696	0.00000059	0.000559	0.071376	0.010	<b>7.14</b>	---	0.10	0.693	---
							---	<b>9.43</b>		---	<b>1.15</b>
					AUF	0.0003	---	0.003		---	0.000
PCB Congeners	0.00000017	0.00000000017	0	0.0000000015	0.00000017	0.0000005	---	0.345	0.0000053	---	0.033
					AUF	0.0029	---	0.001		---	0.0001

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight



TABLE 4-18

REFINEMENT OF RISK TO BENTHIC INVERTEBRATES - NORTH DEVIL'S SWAMP LAKE AOI  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

<i>Parameter</i>	<i>Value</i>	<i>Consensus Benchmarks</i>		
		<i>TEC</i>	<i>PEC</i>	<i>Mid-Point</i>
<i>Ecological Benchmark (ug/kg)</i>		59.8	676	368
<i>Maximum Detected Concentration (ug/kg)</i>	5,200			
No. of Samples Exceeding Benchmark		15	4	8
Percent of Samples Exceeding Benchmark		100%	27%	53%

## Notes:

PEC = Probable effects concentration  
 TEC = Threshold effects concentration  
 ug/kg = micrograms per kilogram

TABLE 4-19

FOOD CHAIN RESULTS FOR GREEN HERON - NORTH DEVIL'S SWAMP LAKE AOI - SEDIMENT  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion						NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Benthic Invertebrates (mg [WW]/kg-day)	Fish (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.0027	0.0059	0.00006	0.0000013	0.000027	0.0087	0.18	0.048	---	0.36	0.0241	---
Aroclor-1221	0.0034	0.0075	0.00008	0	0.000035	0.0110	0.180	0.061	---	0.36	0.0306	---
Aroclor-1232	0.0032	0.0069	0.00007	0	0.000032	0.0102	0.180	0.057	---	0.36	0.0284	---
Aroclor-1242	0.1687	0.3684	0.00028	0	0.001707	0.5391	0.410	1.315	---	0.36	1.4976	---
Aroclor-1248	0.0017	0.0037	0.00004	0	0.000017	0.0055	0.180	0.031	---	0.36	0.0153	---
Aroclor-1254	1.4472	3.1579	0.02343	0	0.014635	4.6431	0.180	25.8	---	1.8	2.58	---
Aroclor-1260	0.1215	0.2655	0.00939	0	0.001230	0.3976	0.180	2.21	---	0.36	1.10	---
						AUF	1	---	29.5		---	5.28
								---	29.5		---	5.28
PCB Congeners	0.000047	0.00011	0.00000027	0	0.00000053	0.00016	0.000014	---	11.1	0.00014	---	1.11
						AUF	1	---	11.1		---	1.11

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-20

**FOOD CHAIN RESULTS FOR LITTLE BROWN BAT - NORTH DEVIL'S SWAMP LAKE AOI - SEDIMENT**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Constituent of Concern	Ingestion				NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Soil Invertebrates (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.00497	0.0000000000	0	0.0050	4.66	0.001	---	11.66	0.000	---
Aroclor-1221	0.00633	0	0	0.0063	0.051	0.124	---	0.508	0.012	---
Aroclor-1232	0.00587	0	0	0.0059	0.051	0.115	---	0.508	0.012	---
Aroclor-1242	0.31114	0	0	0.3111	0.234	1.330	---	2.345	0.133	---
Aroclor-1248	0.00316	0	0	0.0032	0.051	0.062	---	0.508	0.006	---
Aroclor-1254	2.66889	0	0	2.6689	0.079	33.8	---	0.795	<b>3.36</b>	---
Aroclor-1260	0.22412	0	0	0.2241	0.051	<b>4.39</b>	---	0.508	0.441	---
						---	<b>39.8</b>		---	<b>3.96</b>
				AUF	1	---	<b>39.8</b>		---	<b>3.96</b>
PCB Congeners	0.000018	0	0	0.000018	0.0000001	---	<b>180</b>	0.000001	---	<b>18.0</b>
				AUF	1	---	<b>180</b>		---	<b>18.0</b>

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-21

FOOD CHAIN RESULTS FOR MUSKRAT - NORTH DEVIL'S SWAMP LAKE AOI - SEDIMENT  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Aquatic Plants (mg [WW]/kg-day)	Benthic Invertebrates (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.0000	0.00037	0.0000014	0.00001	0.0004	1.38	0.0003	---	3.46	0.0001	---
Aroclor-1221	0.0000	0.00047	0	0.00001	0.0005	0.070	0.007	---	0.696	0.0007	---
Aroclor-1232	0.0000	0.00043	0	0.00001	0.0005	0.070	0.007	---	0.696	0.0007	---
Aroclor-1242	0.0013	0.02297	0	0.00056	0.0248	0.070	0.357	---	0.696	0.0357	---
Aroclor-1248	0.0000	0.00023	0	0.00001	0.0003	0.011	0.023	---	0.111	0.0023	---
Aroclor-1254	0.0112	0.19707	0	0.00481	0.2130	0.053	<b>4.014</b>	---	0.531	0.4014	---
Aroclor-1260	0.0010	0.01655	0	0.00040	0.0179	0.070	<b>0.257</b>	---	0.696	0.0257	---
							---	<b>4.67</b>		---	0.467
					AUF	1	---	<b>4.67</b>		---	0.467
PCB Congeners	0.000000085	0.0000013	0	0.000000036	0.0000015	0.000000095	---	<b>15.4</b>	0.00000095	---	<b>1.54</b>
					AUF	1	---	<b>15.4</b>		---	<b>1.54</b>

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-22

FOOD CHAIN RESULTS FOR BALD EAGLE - NORTH DEVIL'S SWAMP LAKE AOI - SEDIMENT  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)
	Fish (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)			
Aroclor-1016	0.0015	0.00004	5.22667E-07	0.000006	0.0016	0.18	0.009	---
Aroclor-1221	0.0020	0.00006	0	0.000008	0.0020	0.180	0.011	---
Aroclor-1232	0.0018	0.00005	0	0.000008	0.0019	0.180	0.010	---
Aroclor-1242	0.0965	0.00021	0	0.000405	0.0971	0.410	0.237	---
Aroclor-1248	0.0010	0.00003	0	0.000004	0.0010	0.180	0.006	---
Aroclor-1254	0.8270	0.01725	0	0.003468	0.8477	0.180	<b>4.71</b>	---
Aroclor-1260	0.0695	0.00691	0	0.000291	0.0767	0.180	0.426	---
							---	<b>5.41</b>
					AUF	0.0027	---	0.015
PCB Congeners	0.000028	0.0	0	1.24988E-07	0.000029	0.000014	---	<b>2.04</b>
					AUF	0.0027	---	0.006

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-23

FOOD CHAIN RESULTS FOR MINK - NORTH DEVIL'S SWAMP LAKE AOI - SEDIMENT  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Fish (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.0035	0.00003	1.38586E-06	0.00002	0.0036	1.37	0.0026	---	3.43	0.0010	---
Aroclor-1221	0.0045	0.00004	0	0.00002	0.0045	0.015	0.303	---	0.15	0.0303	---
Aroclor-1232	0.0042	0.00004	0	0.00002	0.0042	0.015	0.281	---	0.15	0.0281	---
Aroclor-1242	0.2203	0.00015	0	0.00121	0.2217	0.069	<b>3.21</b>	---	0.69	0.3213	---
Aroclor-1248	0.0022	0.00002	0	0.00001	0.0023	0.015	0.151	---	0.15	0.0151	---
Aroclor-1254	1.8885	0.01246	0	0.01037	1.9113	0.140	<b>13.7</b>	---	0.69	<b>2.77</b>	---
Aroclor-1260	0.1588	0.00499	0	0.00087	0.1646	0.015	<b>11.0</b>	---	0.15	<b>1.10</b>	---
							---	<b>28.6</b>		---	<b>4.26</b>
					AUF	0.0013	---	0.037		---	0.006
PCB Congeners	0.000012	0.000000046	0	0.000000079	0.000012	0.0000008	---	<b>15.0</b>	0.000008	---	<b>1.50</b>
					AUF	0.0013	---	0.019		---	0.002

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-24

REFINEMENT OF RISK TO BENTHIC INVERTEBRATES - SOUTH DEVIL'S SWAMP LAKE AOI  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

<i>Parameter</i>	<i>Value</i>	<i>Consensus Benchmarks</i>		
		<i>TEC</i>	<i>PEC</i>	<i>Mid-Point</i>
<i>Ecological Benchmark (ug/kg)</i>		59.8	676	368
<i>Maximum Detected Concentration (ug/kg)</i>	360			
No. of Samples Exceeding Benchmark		6	0	0
Percent of Samples Exceeding Benchmark		60%	0%	0%

## Notes:

PEC = Probable effects concentration  
 TEC = Threshold effects concentration  
 ug/kg = micrograms per kilogram

TABLE 4-25

FOOD CHAIN RESULTS FOR GREEN HERON - SOUTH DEVIL'S SWAMP LAKE AOI - SEDIMENT  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion						NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Benthic Invertebrates (mg [WW]/kg-day)	Fish (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.0005	0.0010	0.00006	0	0.000007	0.0016	0.18	0.009	---	0.36	0.0044	---
Aroclor-1221	0.0006	0.0014	0.00008	0	0.000009	0.0021	0.180	0.012	---	0.36	0.0058	---
Aroclor-1232	0.0006	0.0012	0.00007	0	0.000008	0.0018	0.180	0.010	---	0.36	0.0051	---
Aroclor-1242	0.0113	0.0222	0.00028	0	0.000325	0.0341	0.410	0.083	---	0.36	0.0947	---
Aroclor-1248	0.0003	0.0007	0.00004	0	0.000005	0.0010	0.180	0.006	---	0.36	0.0028	---
Aroclor-1254	0.1024	0.2231	0.02343	0	0.001534	0.3504	0.180	1.95	---	1.8	0.1947	---
Aroclor-1260	0.0246	0.0537	0.00939	0	0.000385	0.0881	0.180	0.490	---	0.36	0.2448	---
								---	2.56		---	0.552
						AUF	1	---	2.56		---	0.552
PCB Congeners	0.000024	0.000055	0.00000027	0	0.00000029	0.00008	0.000014	---	5.73	0.00014	---	0.573
						AUF	1	---	5.73		---	0.573

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight



TABLE 4-26

FOOD CHAIN RESULTS FOR LITTLE BROWN BAT - SOUTH DEVIL'S SWAMP LAKE AOI - SEDIMENT  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion				NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Soil Invertebrates (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.00088	0	0	0.0009	4.66	0.000	---	11.66	0.000	---
Aroclor-1221	0.00115	0	0	0.0012	0.051	0.023	---	0.508	0.002	---
Aroclor-1232	0.00102	0	0	0.0010	0.051	0.020	---	0.508	0.002	---
Aroclor-1242	0.02079	0	0	0.0208	0.234	0.089	---	2.345	0.009	---
Aroclor-1248	0.00057	0	0	0.0006	0.051	0.011	---	0.508	0.001	---
Aroclor-1254	0.18882	0	0	0.1888	0.079	<b>2.39</b>	---	0.795	0.238	---
Aroclor-1260	0.04540	0	0	0.0454	0.051	0.890	---	0.508	0.089	---
						---	<b>3.42</b>		---	0.341
				AUF	1	---	<b>3.42</b>		---	0.341
PCB Congeners	0.000011	0	0	0.000011	0.0000001	---	<b>111</b>	0.000001	---	<b>11.1</b>
				AUF	1	---	<b>111</b>		---	<b>11.1</b>

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-27

**FOOD CHAIN RESULTS FOR BALD EAGLE - SOUTH DEVIL'S SWAMP LAKE AOI - SEDIMENT**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)
	Fish (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)			
Aroclor-1016	0.0003	0.00004	0	0.000002	0.0003	0.18	0.002	---
Aroclor-1221	0.0004	0.00006	0	0.000002	0.0004	0.180	0.002	---
Aroclor-1232	0.0003	0.00005	0	0.000002	0.0004	0.180	0.002	---
Aroclor-1242	0.0058	0.00021	0	0.000077	0.0061	0.410	0.015	---
Aroclor-1248	0.0002	0.00003	0	0.000001	0.0002	0.180	0.001	---
Aroclor-1254	0.0584	0.01725	0	0.000363	0.0760	0.180	0.422	---
Aroclor-1260	0.0141	0.00691	0	0.000091	0.0211	0.180	0.117	---
							---	0.562
					AUF	0.0022	---	0.0012
PCB Congeners	0.000014	0.0000002	0	0.00000007	0.000015	0.000014	---	1.05
					AUF	0.0022	---	0.0023

## Notes:

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 4-28

FOOD CHAIN RESULTS FOR MINK - SOUTH DEVIL'S SWAMP LAKE AOI - SEDIMENT  
 STEP 3 - PROBLEM FORMULATION  
 DEVIL'S SWAMP LAKE SITE  
 EAST BATON ROUGE PARISH, LOUISIANA

Constituent of Concern	Ingestion					NOAEL (mg/kg-day)	HQ <sub>NOAEL</sub> (Unitless)	HI <sub>NOAEL</sub> (Unitless)	LOAEL (mg/kg-day)	HQ <sub>LOAEL</sub> (Unitless)	HI <sub>LOAEL</sub> (Unitless)
	Fish (mg [WW]/kg-day)	Terrestrial Mammals (mg [WW]/kg-day)	Water (mg/kg-day)	Sediment (mg [DW]/kg-day)	Total (mg/kg-day)						
Aroclor-1016	0.0006	0.00003	0	0.00001	0.0007	1.37	0.0005	---	3.43	0.0002	---
Aroclor-1221	0.0008	0.00004	0	0.00001	0.0009	0.015	0.057	---	0.15	0.0057	---
Aroclor-1232	0.0007	0.00004	0	0.00001	0.0008	0.015	0.051	---	0.15	0.0051	---
Aroclor-1242	0.0133	0.00015	0	0.00023	0.0137	0.069	0.198	---	0.69	0.0198	---
Aroclor-1248	0.0004	0.00002	0	0.00000	0.0004	0.015	0.028	---	0.15	0.0028	---
Aroclor-1254	0.1334	0.01246	0	0.00109	0.1469	0.140	<b>1.05</b>	---	0.69	0.2130	---
Aroclor-1260	0.0321	0.00499	0	0.00027	0.0374	0.015	<b>2.49</b>	---	0.15	0.2494	---
							---	<b>3.88</b>		---	0.496
					AUF	0.001	---	0.004		---	0.0005
PCB Congeners	0.000007	0.000000046	0	0.000000051	0.000007	0.0000008	---	<b>8.80</b>	0.000008	---	0.880
					AUF	0.001	---	0.009		---	0.001

## Notes:

Bold font indicates that the HQ value exceeds unity (1.0)

AUF = Area Use Factor

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

PCB = Polychlorinated biphenyl

HI = Hazard Index (equal to the sum of the Hazard Quotients for Aroclors)

HQ = Hazard Quotient

mg/kg-day = milligrams per kilogram-day

L/kg-day = liters per kilogram-day

WW = wet weight

DW = dry weight

TABLE 6-1

**ASSESSMENT ENDPOINTS FOR THE BASELINE ECOLOGICAL RISK ASSESSMENT  
STEP 3 - PROBLEM FORMULATION  
DEVIL'S SWAMP LAKE SITE  
EAST BATON ROUGE PARISH, LOUISIANA**

<i>Assessment Endpoint</i>	<i>Area of Investigation</i>			
	<i>North-Central Devil's Swamp</i>	<i>Drainage Ditch</i>	<i>North Devil's Swamp Lake</i>	<i>South Devil's Swamp Lake</i>
<i>Sediment</i>				
Survival, growth and reproduction of benthic invertebrates <sup>a</sup>	---	●	●	---
Growth and reproduction of avian insectivores	●	●	●	●
Growth and reproduction of mammalian insectivores	●	●	●	●
Growth and reproduction of mammalian herbivores	---	---	●	---
Growth and reproduction of avian piscivores	●	●	●	●
Growth and reproduction of mammalian piscivores	●	●	●	●
Sub-Lethal toxic effects due PCB residues in tissues of benthic invertebrates and fish	●	●	●	●
<i>Soil</i>				
Growth and reproduction of mammalian insectivores	---	●	---	---
Growth and reproduction of mammalian herbivores	---	●	---	---

Notes:

<sup>a</sup> - Assessment endpoint for benthic invertebrates includes crawfish

TABLE 7-1

**RISK QUESTIONS AND RISK HYPOTHESES FOR THE BASELINE ECOLOGICAL RISK ASSESSMENT**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Assessment Endpoint</i>	<i>Risk Question</i>	<i>Testable Hypotheses</i>
<i>Sediment</i>		
Survival, growth and reproduction of benthic invertebrates	Are concentrations of aroclors and congeners sufficiently elevated to adversely affect the survival, growth, and/or reproduction of benthic invertebrates that inhabit the sediment within the Drainage Ditch and North Devil's Swamp Lake AOIs?	Growth, survival, and/or reproduction of surrogate benthic species exposed to sediment from the AOIs are statistically lower than those exposed to control or reference site sediment.
Growth and reproduction of avian insectivores  Growth and reproduction of mammalian insectivores	Are concentrations of aroclors and congeners sufficiently elevated in benthic invertebrates consumed by avian and mammalian insectivores in all four AOIs to adversely affect growth and reproduction?	Food chain models for insectivores have HIs greater than unity based on 95% UCL concentrations of aroclors and congeners measured in tissues of benthic invertebrates collected from the individual AOIs.
Growth and reproduction of mammalian herbivores	Are concentrations of aroclors and congeners sufficiently elevated in plant tissue consumed by avian and mammalian insectivores in the North Devil's Swamp Lake AOI to adversely affect growth and reproduction?	Food chain models for herbivores have HIs greater than unity based on 95% UCL concentrations of aroclors and congeners measured in plant tissue collected from the North Devil's Swamp Lake AOI.
Growth and reproduction of avian piscivores  Growth and reproduction of mammalian piscivores	Are concentrations of aroclors and congeners sufficiently elevated in fish consumed by avian and mammalian insectivores in the Drainage Ditch AOI to adversely affect growth and reproduction?	Food chain models for insectivores have HIs greater than unity based on 95% UCL concentrations of aroclors and congeners measured in fish tissue collected from the Drainage Ditch AOI.
Sub-lethal toxic effects to benthic invertebrates and fish due to direct exposure to PCBS	Are concentrations of PCBs in the tissue of benthic invertebrates and fish sufficiently elevated in tissues to cause sub-lethal effects?	Concentrations in the tissue of benthic invertebrates and fish are above published benchmarks for sub-lethal effects.

TABLE 7-1

**RISK QUESTIONS AND RISK HYPOTHESES FOR THE BASELINE ECOLOGICAL RISK ASSESSMENT**  
**STEP 3 - PROBLEM FORMULATION**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Assessment Endpoint</i>	<i>Risk Question</i>	<i>Testable Hypotheses</i>
<i>Soil</i>		
Growth and reproduction of mammalian insectivores	Are concentrations of aroclors and congeners sufficiently elevated in tissue of soil invertebrates consumed by mammalian insectivores in the Drainage Ditch AOI to adversely affect growth and reproduction?	Food chain models for insectivores have HIs greater than unity based on 95% UCL concentrations of aroclors and congeners measured in tissue of soil invertebrates collected from the Drainage Ditch AOI.
Growth and reproduction of mammalian herbivores	Are concentrations of aroclors and congeners sufficiently elevated in the tissue of terrestrial plants consumed by mammalian insectivores in the Drainage Ditch AOI to adversely affect growth and reproduction?	Food chain models for herbivores have HIs greater than unity based on 95% UCL concentrations of aroclors and congeners measured in tissue of terrestrial plants collected from the Drainage Ditch AOI.

## Notes:

HI = Hazard index

UCL = Upper confidence limit

AOI = Area of Investigation

## APPENDIX A

### EPA AND LDEQ REVIEW COMMENTS ON THE STEP 3 – PROBLEM FORMULATION FOR THE BERA REPORT

APPENDIX A

AGENCY REVIEW COMMENTS ON THE STEP 3 – PROBLEM FORMULATION FOR THE BASELINE ECOLOGICAL RISK ASSESSMENT  
DEVIL'S SWAMP LAKE SITE  
CERCLA DOCKET NO. 06-04-10, LDEQ AI No. 86800, EPA ID LAD981155872  
EAST BATON ROUGE PARISH, LOUISIANA  
NOVEMBER 2011

Item No.		Comment	Response	A Revision is Included in the Final Step 3- Problem Formulation for the BERA Report in the Location Cited Below
Comments to Mr. Bart Canellas in a letter from Mr. Barry Forsythe of the US Fish and Wildlife Service, dated October 28, 2011				
1	General	The purpose of Step 3 is not to re-evaluate the SLERA and adjust the screening values. More realistic assumptions regarding exposure (area use, central tendency of exposure point concentrations, etc.) are supposed to be applied, rather than deriving a higher screening value.	The USEPA guidance for the Step 3 refinement process is relatively vague and open to interpretation. However, the guidance is clear that factors other than exposure should be considered in the refinement process, including “characterizing ecological effects of contaminants ” and “known ecological effects, including “NOAELs and LOAELs”. For the SLERA, the lowest available ecological benchmarks were selected as ESVs, which are essentially no effects levels. Using sediment as an example, the refinement benchmark is the mid-point of the threshold effect level (TEC) and probable effect level (PEC) identified by MacDonald et al. (2000). Use of a no effect benchmark, such as the TEC, is very conservative and has limited value in predicting the potential for adverse population or community-scale effects. Conversely, the PEC represents a concentration above which adverse effects are likely. Use of the PEC likewise has limited value in the refinement process, as it may underestimate the potential for risk. The mid-point of the TEC and PEC was used to balance conservatism with a realistic evaluation of the probability of population and community level effects on benthic invertebrates.	No revision was made to the report.
2	General	The document states several times that due to sample size, some measure of central tendency other than the 95 UCL was necessary. I see this as highlighting a major data gap. In the cases where the 95 UCL exceeds the maximum it is common practice to utilize the maximum as the exposure point concentration (EPC). Suggest using the maximum or collecting additional data so as to be able to calculate an acceptable 95 UCL.	<p>Clean Harbors recognizes that a common practice is to use the maximum concentration as the exposure concentration if the 95% UCL is greater than the maximum. However, if one of the objectives of Step 3 is to provide a more realistic estimate of exposure concentrations, then use of the maximum concentration is not likely to be very representative of the central tendency and does not achieve this objective, particularly for those constituents that have a very low frequency of detection (e.g., Aroclor 1260 was detected in 1 of 12 surface water samples from the Drainage Ditch). Therefore it is also a common practice to establish a minimum percentage, such as 5%, of sample constituent detections from a given area before further evaluating the possible risk associated with that constituent. If a constituent is rare within an assessment area, additional sampling is not likely to provide a sufficient number of samples with detected concentrations to calculate a UCL, and we have presented a balance between these two extreme approaches. If an aroclor was not detected in a medium, then the midpoint between the lowest and highest detection limits was used as the exposure concentration.</p> <p>If an aroclor was detected, but at a frequency of detection insufficient to calculate a 95% UCL, a value judged to be a reasonable exposure concentration other than the maximum was selected based on the data available. To clarify the selection of exposure concentrations, Tables 1-5 (attached) provide the summary statistics for aroclors in each AOI.</p>	Appendix C
3	General	The uncertainty associated with utilizing only “calculated” food chain (e.g., tissue concentrations) exposures is concerning when the analyses yield a result indicating acceptable risk to avian piscivores at a PCB site.	Clean Harbors agrees that use of only calculated food chain exposures for PCBs introduces a high degree of uncertainty into the analyses. As discussed during the meeting on November 9, 2011, for the BERA, fish will be collected for analysis of PCBs. The ingestion of PCBs will then be re-calculated based on tissue concentrations and the food chain models revised accordingly.	Sections 4.1.2, 4.3.2, and 4.4.2
4	General	Area Use Factors (AUFs) utilized in the upper trophic receptor evaluations should take into account receptors foraging throughout the site, as habitat is appropriate. It would be most realistic to evaluate exposures for mammals across the site (i.e., mammalian carnivores/ piscivores are likely to forage throughout as habitat dictates) and avian piscivores (i.e., Bald Eagles) for all of Devil’s Swamp Lake (e.g., both North and South AOIs combined).	The SLERA and Problem Formulation evaluated risk to upper level trophic receptors for each of the AOIs in order to identify the potential for risk posed within the individual AOIs. As fish will be collected and analyzed for PCBs for the BERA, the concentration of PCBs in fish tissue will be representative of exposure throughout all of the open water habitats within the North Central Devil’s Swamp, North Devil’s Swamp Lake, and South Devil Devil’s Swamp Lake AOIs. Revised Table 6.1 and Figures 7.3 and 7.4 are attached.	Table 6-1 and Figures 7-3 and 7-4
5	General	The Assessment Endpoints, CSM, etc. may require revision based on results from addressing the comments here.	Based on the uncertainty of risk to avian and mammalian piscivores, the Assessment Endpoints (Table 6.1) and CSMs for the North Devil’s Swamp Lake (Figure 7.3) and South Devil’s Swamp Lake (Figure 7.4) have been revised to identify the pathways for avian and mammalian piscivores as potentially complete.	Section 2.2, Table 6-1, Figure 7-3, and Figure 7-4



APPENDIX A

AGENCY REVIEW COMMENTS ON THE STEP 3 – PROBLEM FORMULATION FOR THE BASELINE ECOLOGICAL RISK ASSESSMENT  
DEVIL'S SWAMP LAKE SITE  
CERCLA DOCKET NO. 06-04-10, LDEQ AI No. 86800, EPA ID LAD981155872  
EAST BATON ROUGE PARISH, LOUISIANA  
NOVEMBER 2011

Item No.		Comment	Response	A Revision is Included in the Final Step 3- Problem Formulation for the BERA Report in the Location Cited Below
Specific Comments				
1	Page 5, §2.1.3, 1st paragraph, 4th line	Insert a space between “water” and “and” (“water and”).	The revision will be made as requested.	Page 5, Section 2.1.3, 1st paragraph, 4th line
2	Page 8, §3.1, SURFACE WATER, Refinement Benchmarks	What is the rationale for choosing a different benchmark? The selected RB of 0.369 ug/L is above the NAWQC acute value of 0.2 ug/L (arochlor 1254) and well above the NAWQC chronic value of 0.014 ug/L. In addition, the ORNL secondary chronic value is 0.14 ug/L; the same value selected as the ecological screening value (ESV) for the Savannah River Site (1999).	Section 3.1 deals with the refinement of fish and aquatic plants exposed to surface water. The refinement benchmark referenced in this comment is 0.369 µg/L for fish. The ESV for exposure of fish to surface water was the lowest available ecological benchmark for fish, which is the lowest chronic value (LCV) identified by Suter and Tsao (1996). As discussed in the response to General Comment No. 1, continued use of the most conservative benchmark has limited value in the refinement process. The refinement benchmark of 0.369 µg/L, which is specific to fish, is the geometric of the three benchmarks identified by Suter and Tsao (1996). The three benchmarks are similar, ranging from 0.2 to 0.63 µg/L). Use of the geometric mean of available benchmarks is common practice for deriving ecological benchmarks (e.g., MacDonald et al. 2000). As shown in Table 4.6, the 95% UCL is below all three benchmarks used to calculate the geometric mean of 0.369 µg/L. Therefore, the direct contact pathway for fish exposed to surface water would be eliminated in the refinement process, regardless of the benchmark used.	No revision was made to the report.
3	Page 9, §3.2.1, BENTHIC INVERTEBRATES, Refinement Benchmarks	What is the rationale for choosing a different benchmark? Suggest reporting HQ calculations for the two bounding benchmarks (e.g., TEC and PEC) to allow the risk manager to evaluate the range of possible risks (i.e., just as NOAEL and LOAEL HQs are presented for upper trophic receptors).	See response to General Comment No. 1 for the rationale for choosing a different benchmark. As shown in Tables 4.1, 4.7, 4.18, and 4.18, the number of samples that exceed the TEC and PEC, as well as the midpoint, is identified.	No revision was made to the report.
4	Page 12, §3.2.2, Equation 4	Provide additional supporting evidence for utilizing the same BSAF (1.1) for fish that was used for invertebrates. Buchanan et al. (2007, attached) report sediment BAFs to be highly species-specific and range from 0.20 to 7.5.	The BSAF of 1.1, which is based on the USEPA (1999) sediment-to-benthic invertebrate BSAF, was used as a “base” BSAF for both benthic invertebrates and fish due to the absence of site-specific sediment-to-fish BSAF. The BSAFs for benthic invertebrates and fish were adjusted for literature values for lipid content in fish (6%) and invertebrates (2%), which resulted in a bioconcentration in fish that was approximately three times higher than for invertebrates. Clean Harbors acknowledges there is a high degree of uncertainty associated with using these literature values, as well as the values presented in Buchanan (2007). To minimize this uncertainty, for the BERA, fish tissue samples will be collected for analysis of PCBs. The ingestion of PCBs will then be re-calculated based on tissue concentrations and the food chain models revised accordingly.	Sections 4.1.2, 4.3.2, and 4.4.2
5	Page 27, §4.3.2, Avian Piscivores	It’s premature to conclude no risk to avian piscivores in Devil’s Swamp Lake. Firstly, the greatest threat to exposure is via biomagnification with consumption of fish (See General Comments 3&4, Specific Comment 4). Since this lake is not extremely large, it could be argued that fish could and would move freely throughout the lake and not have high site fidelity to only one portion. Secondly, while no longer listed as a T&E species, the Bald Eagle retains similar “no take” protections under the Bald and Golden Eagle Protection Act (1940). Site-specific fish tissue data is needed to adequately evaluate risks to Bald Eagles. The TRV utilized should be a conservative NOAEL for reproduction.	As discussed in the responses to General Comment No. 4, fish sampled for the BERA will be representative of exposure throughout all of the open water habitats within the assessment area. As was done in the SLERA and Problem Formulation, risk to Bald Eagle will consider only the NOAEL.	No revision was made to the report.

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AGENCY REVIEW COMMENTS ON THE STEP 3 – PROBLEM FORMULATION FOR THE BASELINE ECOLOGICAL RISK ASSESSMENT  
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EAST BATON ROUGE PARISH, LOUISIANA  
NOVEMBER 2011

Item No.		Comment	Response	A Revision is Included in the Final Step 3- Problem Formulation for the BERA Report in the Location Cited Below
6	Page 29, §4.4.2, Avian Piscivores	It’s premature to conclude no risk to avian piscivores in Devil’s Swamp Lake. Firstly, the greatest threat to exposure is via biomagnification with consumption of fish (See General Comments 3&4, Specific Comment 4). Since this lake is not extremely large, it could be argued that fish could and would move freely throughout the lake and not have high site fidelity to only one portion. Secondly, while no longer listed as a T&E species, the Bald Eagle retains similar “no take” protections under the Bald and Golden Eagle Protection Act (1940). Site-specific fish tissue data is needed to adequately evaluate risks to Bald Eagles. The TRV utilized should be a conservative NOAEL for reproduction.	See response to General Comment No. 5.	No revision was made to the report.
7	Page 31, §5.0, 1st paragraph	See Specific Comments 5 and 6.	See response to General Comment No. 5.	No revision was made to the report.
8	Page 31, §5.0, 2nd paragraph	Additional information should be provided describing the process of biomagnification.	See response to General Comment No. 5.	No revision was made to the report.
9	Page 34, §8.0, 3rd paragraph	This uncertainty should be addressed in the BERA by sampling site-specific tissue residues.	See response to General Comment No. 5.	No revision was made to the report.
EPA Comments				
1	General	The entire Problem Formulation is based on the premise that Aroclors/PCBs are the only contaminants of potential ecological concern (COPEC). The identification of any additional COPEC may significantly change this document.	Clean Harbors will consider evaluation of additional COPECs in the BERA.	No revision was made to the report.
2	Sections 3.1, 3.2.1, and 3.2.2	Sections 3.1, 3.2.1, and 3.2.2 provide discussions about the exposure concentrations for the risk refinement. Text in each of these sections notes that the 95% upper confidence limit (UCL) was used when there were sufficient data, but that under some circumstances other measures of central tendency (mean, median, geometric mean) have been used. There are no summary tables of these exposure point concentrations (EPCs), nor the methodology (e.g. median, geometric mean, etc.) used to select the EPCs. Suggests that summary tables showing these data be included in the document.	See response to USFWS General Comment No. 2.	Appendix C

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NOVEMBER 2011

Item No.		Comment	Response	A Revision is Included in the Final Step 3- Problem Formulation for the BERA Report in the Location Cited Below
3	Section 5.0, last paragraph	This paragraph attempts to explain how the drainage ditch area of investigation (AOI) is small and therefore unlikely to have a significant impact on the overall function of the site ecosystem. However, in Section 6 the drainage ditch is acknowledged as a potential risk to multiple receptors. Furthermore, it may be possible that the drainage ditch is acting as a source of PCB migration to the surrounding ecosystem. The validity of this paragraph is questioned. Suggests that additional rationale to support the opinion in this paragraph or the paragraph should be deleted.	The paragraph will be deleted as requested.	Section 5.0, last paragraph
4	Page i, second paragraph, second sentence	This sentence concludes that the methods and assumptions used in the screening-level ecological risk assessment resulted in an overestimation of the risk for several exposure pathways and exposure groups. Suggests changing from “This resulted in an overestimation...” to “This may have resulted in an overestimation...”	The paragraph will be revised as requested.	Executive Summary (page i), second paragraph, second sentence
5	General	EPA’s key anticipation is to see at the end HQs for each COPEC and total HIs for each receptor group and a discussion of uncertainties and considerations that need to be taken in account while reviewing these numbers so as to reach a management decision.	The SLERA and Problem Formulation presented HQs for the individual aroclors and HIs for total PCB aroclors and PCB congeners. If additional chemicals are evaluated in the BERA (see response to EPA Comment No. 1), HQs and HIs for each receptor group will be presented. The BERA will provide a detailed discussion of the uncertainties and key considerations in developing risk management decisions.	Tables 4-1 through 4-28
LDEQ Comments provided to Mr. John Arbuthnot of Clean Harbors in a letter dated November 28, 2011				
1	General	A significant amount of information regarding ecological risks was generated during the 1999 BERA. Consideration of this information would be valuable in the screening and problem formulation steps by serving to focus the current assessment on the risks most likely to be present and thereby reducing uncertainty in the screening process.	Clean Harbors acknowledges that the 1999 BERA generated a significant amount of data regarding ecological risk. Unfortunately, only a small amount of those data are directly applicable to the assessment area evaluated in the SLERA and Problem Formulation (Devil’s Swamp Lake). In addition, the data are more than 12 years old. Given the dynamic nature of sediment movement and transport in aquatic systems, it is uncertain if data collected in Devil’s Swamp Lake prior to 1999 represent current conditions at the site. Furthermore, the historical data did not meet QA/QC criteria for inclusion in the site characterization and risk assessments. Based on discussions during the meeting on November 9, 2011, the data collected in 2011 identify a potential for risk to avian and mammalian insectivores that forage on benthic invertebrates and fish. The data collection program for the Tier 2 investigation and BERA will focus on these pathways and receptors. As suggested in the comment, the results of the BERA will compare the results of the risk assessments for the Clean Harbors’ assessment area to those presented in the 1999 BERA, where applicable.	Sections 4.1.2, 4.3.2, and 4.4.2
2	Page 8	Ecological benchmarks for aroclors in surface water are available in Preliminary Remediation Goals for Ecological Endpoints, Efroymson et al 1997 (ESIERITM-1621R2).	Efroymson et al. (1997) identify ecological benchmarks for the individual aroclors for surface water. The benchmarks for Aroclor 1221, Aroclor 1232, and Aroclor 1260 are for the aquatic life. The benchmarks for the other aroclors are specific to piscivores. Risk to piscivores was evaluated through use food chain models, which included ingestion of the individual aroclors via drinking water. Of the three aroclors with benchmarks specific to aquatic life, Aroclor 1221 and Aroclor 1232 were not detected in any samples from any of the AOIs. Aroclor 1260 was detected in 10 of 12 samples from the Drainage Ditch AOI at a maximum concentration of 0.22 µg/L. Aroclor 1260 was detected in one of 15 samples from the North Devil’s Swamp Lake AOI at a concentration of 0.022 µg/L. The ecological benchmark identified by Efroymson et al. (1997) for Aroclor 1260 is 94 µg/L. The maximum concentrations for both the Drainage Ditch and North Devil’s Swamp Lake AOIs are below this benchmark. Consequently, application of the ecological benchmark for Aroclor 1260 does not change the conclusions of the SLERA or Problem Formulation.	No revision was made to the report.
3		Provide summary statistics for each media/COC; provide justification for the central tendency value selected to represent the exposure concentration for screening and/or modeling efforts.	See response to USFWS General Comment No. 2 and Tables 1-5.	Appendix C

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AGENCY REVIEW COMMENTS ON THE STEP 3 – PROBLEM FORMULATION FOR THE BASELINE ECOLOGICAL RISK ASSESSMENT  
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NOVEMBER 2011

Item No.		Comment	Response	A Revision is Included in the Final Step 3- Problem Formulation for the BERA Report in the Location Cited Below
4		BSAF values generally increase with each trophic level. The food chain modeling was based upon the same BSAF for invertebrates and upper trophic level fish. In addition, crawfish, which are an important food source in the water system, were not specifically addressed but likely to have a different BSAF than pelagic fish.	See response to USFWS Specific Comment No. 4.	No revision was made to the report.
5		Consider including the blue heron as a piscivorus avian receptor in the refinement of the SLERA and the problem formulation. The blue heron has a relatively small home range and is frequently present in local water bodies in the area.	As discussed during the meeting on November 9, 2011, the BERA will evaluate risk to avian piscivores that forage on fish in Devil’s Swamp Lake. One of the selection criteria will be a small foraging range. Great blue heron will be considered as an indicator species for avian piscivores.	Sections 4.1.2, 4.3.2, and 4.4.2
6	Section 6.0	Direct toxicity associated with PCB residues in the tissues of fish (and crawfish) was not addressed in the problem formulation (assessment endpoints, Section 6).	Collection and analysis of fish and crawfish in the Tier 2 sampling program will provide data on concentrations of PCBs in fish and invertebrates. These data can be compared to appropriate benchmark concentrations. Direct toxicity has been added as an assessment endpoint to Table 6.1.	Section 2.2 and Table 6-1
7	Section 9.0 Conclusions	Ecological risks associated with PCB contaminated sediment/ aquatic biota are typically associated with piscivore receptors, particularly avian species.	Clean Harbors acknowledges that ecological risk associated with PCBs is typically associated with avian and mammalian piscivores. Collection and analysis of fish tissue for the BERA will reduce the uncertainty in assessing risk for piscivores.	Sections 4.1.2, 4.3.2, and 4.4.2
8	Table 2-2	A wildlife benchmark for PCBs in soil is available in Efroymsen et al 1997.	The wildlife benchmark for PCBs in soil identified in the Work Plan was 0.65 mg/kg as identified by the Washington Department of Ecology. The wildlife benchmark identified by Efroymsen et al. (1997) is 0.371 mg/kg. Soil was evaluated for the North Central Devil’s Swamp AOI and Drainage Ditch AOI. The maximum concentration for the North Central Devil’s Swamp AOI was 0.2967 mg/kg, which is below both benchmarks. The maximum concentration for the Drainage Ditch AOI was 0.75 mg/kg which is above both benchmarks. Consequently, consideration of the benchmark identified by Efroymsen et al. (1997) does not change the conclusions of the SLERA. In the Problem Formulation, risk to avian and mammalian receptors exposed to soil in the Drainage Ditch AOI was evaluated using food chain models for terrestrial receptors. Because risk was evaluated using food chain models, the Problem Formulation did not consider generic benchmarks for wildlife.	No revision was made to the report.
9	Tables 3-15 and 3-16	The IR food values appear to be in error. For example, the IR food for the mink is given as 0.22 mg/kg-d. The body weight is given as 0.99 kg. This equates to a daily food intake of 0.22 mg of food/day (0.22 mg/kg-d x 0.99 kg = 0.22 mg food/day).	LDEQ’s concern regarding the calculation of IR food using mink as an example is not clear. The comment correctly points out that body weight of mink is 0.99 kg. Because this weight approximates 1.0, ingestion expressed as mg food/day and mg food/kg body weight/day is approximately the same (0.22). Ingestion for the food chain models was expressed as mg food/kg body weight/day, which is the unit for the TRVs. For the SLERA and Problem Formulation, ingestion rates were all metrically scaled for body weight in accordance with Nagy (1987). To facilitate LDEQ’s understanding of the calculations, Appendix D provides the calculation of ingestion rates for each indicator species. A few minor typing errors were noted in Tables 3.15 and 3.16. The corrections (noted in bold font in Appendix D) did not affect the food chain model calculations or the results and conclusions of the Problem Formulation.	Tables 3-15 and 3-16; Section 3.4; Appendix D
10		Sufficient documentation should be provided to allow for verification of the food chain results used in the SLERA.	The tables provided in the SLERA and Problem Formulation provide concentrations of aroclors and congeners in media (surface water, sediment, and soil) and prey items consumed by avian and mammalian receptors. As fish and crayfish will be collected and analyzed for the BERA, the exposure concentrations based on tissue analyses will differ from those presented in the SLERA and Problem Formulation. The BERA will include tables similar to those presented in the Problem Formulation, but will also include detailed calculations for the food chain models, likely in the form of Appendices.	Appendix C

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AGENCY REVIEW COMMENTS ON THE STEP 3 – PROBLEM FORMULATION FOR THE BASELINE ECOLOGICAL RISK ASSESSMENT  
DEVIL'S SWAMP LAKE SITE  
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EAST BATON ROUGE PARISH, LOUISIANA  
NOVEMBER 2011

Item No.		Comment	Response	A Revision is Included in the Final Step 3- Problem Formulation for the BERA Report in the Location Cited Below
LDEQ Comments (Keith Horn) provided to Mr. Bart Canellas of USEPA in an email dated January 25, 2012				
1	Tables 3-15 and 3-16	<p>The LDEQ has one remaining comment concern regarding the BERA Response to Comments provided by Clean Harbors/CRA. This is as follows:</p> <p>LDEQ Item No. 9, Tables 3-15 and 3-16, Comment: The IR food values appear to be in error. For example, the IR food for mink is given as 0.22 mg/kg-d. The body weight is given as 0.99 kg. This equates to a daily food intake of 0.22 mg of food/day (0.22mg/kg-d x 0.99 kg = 0.22 mg food/day).</p> <p>Response: Tables 6 and 7. For the IR Food parameter, units of mg (WW)/kg day are presented in Tables 3-15 and 3-16 (line 2) of the Problem Formulation for the BERA but in Tables 6 and 7 (line 8) of the response, the IR Food is presented in units of kg WW/kg Body wt-day. It appears that the units presented in the BERA are in error and that the correct units are kg WW/kg-d. Clarify if the units of mg WW/kg-d in Tables 3-15 and 3-16 is a typographical error or if the exposure via food intake was underestimated by a factor of 106 in the food chain results.</p>	The units in Tables 3-15 and 3-16 should be kg/kg-day rather than mg/kg-day. It was a typographical error and calculations of food ingestion were not undercalculated. We will provide revised tables with the correction in the Final Step 3 – Problem Formulation Report.	Tables 3-15 and 3-16; Section 3.4

## APPENDIX B

### EPA APPROVAL LETTER



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6

1445 ROSS AVENUE, SUITE 1200  
DALLAS, TX 75202-2733

January 31, 2012

RECEIVED

FEB - 6 2012

CLEAN HARBORS  
BATON ROUGE, LA

Mr. John C. Arbuthnot, P.E.  
Senior Remediation Manager  
Clean Harbors Environmental Services, Inc.  
On behalf of:  
Baton Rouge Disposal, LLC  
13351 Scenic Highway  
Baton Rouge, LA 70807

RE: Devil's Swamp Lake Superfund Site  
Response to comments on the draft  
Step 3 - Baseline Ecological Problem Formulation  
**LDEQ Agency Interest # 86800**

Dear Mr. Arbuthnot:

The following letter summarizes the status of comments and responses to the draft Step 3 Baseline Ecological Problem Formulation (BERA) submitted on October 14, 2011 by Clean Harbors/Conestoga-Rovers & Associates (CH/CRA).

The Environmental Protection Agency (EPA) and the Louisiana Department of Environmental Quality (LDEQ) risk assessors provided comments in our letter of October 17, 2011. Proposed responses were provided on August 23, 2011, further discussed during the November 9, 2011 meeting at the LDEQ offices and summarized in our letter of December 11, 2011. These comments were further discussed during the LDEQ and CH/CRA meeting on December 20, 2011.

More recently, on January 10, 2012, CH/CRA submitted an updated table of responses to review comments for the Step 3 - Problem Formulation for the BERA.

The responses provided at this time, and the clarification of units in Tables 3-15 and 3-16, are acceptable to EPA and LDEQ. Please revise the document by incorporating the responses as appropriate and issue the document as final.

Sincerely yours,

*Bartolomé J. Canellas*  
Bartolomé J Canellas (6SF-RL)  
Remedial Project Manager

cc: Thomas Harris, LDEQ, Administrator  
Underground Storage Tank and Remediation Division  
Keith Horn, LDEQ  
Staff Environmental Scientist  
Pressley L. Campbell, PhD P.E., CRA

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## APPENDIX C

### SUMMARY STATISTICS AND EXPOSURE CONCENTRATIONS FOR SURFACE WATER, SEDIMENT, AND SOIL FOR EACH AREA OF INVESTIGATION



**APPENDIX C, TABLE 1**  
**EXPOSURE CONCENTRATIONS FOR SURFACE WATER, SEDIMENT, AND SOIL**  
**NORTH CENTRAL DEVIL'S SWAMP AOI**  
**STEP 3 - PROBLEM FORMULATION RESPONSE TO COMMENTS**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Medium	Aroclor	No. Samples	No. Detects	Detects		Non-Detects		Summary Statistics				Step 3 Exposure Concentration	Notes
				Min	Max	Min LOD	Max LOD	Mean	GeoMean	Median	95% UCL		
Surface Water (mg/L)	Aroclor-1016	11	0	---	---	0.000012	0.000012	---	---	---	---	0	a
	Aroclor-1221	11	0	---	---	0.000012	0.000012	---	---	---	---	0	a
	Aroclor-1232	11	0	---	---	0.0000014	0.0000014	---	---	---	---	0	a
	Aroclor-1242	11	0	---	---	0.0000088	0.0000092	---	---	---	---	0	a
	Aroclor-1248	11	0	---	---	0.0000011	0.0000011	---	---	---	---	0	a
	Aroclor-1254	11	0	---	---	0.0000011	0.0000011	---	---	---	---	0	a
	Aroclor-1260	11	0	---	---	0.0000064	0.0000067	---	---	---	---	0.00	a
Sediment (mg/kg)	Aroclor-1016	15	0	---	---	0.00077	0.002	---	---	---	---	0.00069	b
	Aroclor-1221	15	0	---	---	0.00099	0.0025	---	---	---	---	0.00087	b
	Aroclor-1232	15	0	---	---	0.00089	0.0022	---	---	---	---	0.00077	b
	Aroclor-1242	15	4	0.0061	0.11	0.00092	0.0021	0.015	0.0016	0.0006	0.099	0.099	c
	Aroclor-1248	15	0	---	---	0.00049	0.0012	---	---	---	---	0.00042	b
	Aroclor-1254	15	10	0.00087	0.17	0.00074	0.001	0.034	0.0043	0.002	0.061	0.061	c
	Aroclor-1260	15	8	0.0063	0.29	0.00081	0.0013	0.031	0.0038	0.006	0.16	0.16	c
Soil (mg/kg)	Aroclor-1016	9	0	---	---	0.00077	0.0011	---	---	---	---	0.00047	b
	Aroclor-1221	9	0	---	---	0.00099	0.0014	---	---	---	---	0.0006	b
	Aroclor-1232	9	0	---	---	0.00089	0.0013	---	---	---	---	0.00055	b
	Aroclor-1242	9	2	0.0061	0.0067	0.00092	0.0012	0.0018	0.00087	0.00049	0.0063	0.0063	c
	Aroclor-1248	9	0	---	---	0.00049	0.00071	---	---	---	---	0.0003	b
	Aroclor-1254	9	5	0.00087	0.0044	0.00074	0.00083	0.0017	0.001	0.00087	0.003	0.003	c
	Aroclor-1260	9	4	0.0063	0.29	0.00081	0.0011	0.036	0.0026	0.00055	0.103	0.103	c
Sediment (mg/kg)	PCB 105	4	4	0.000013	0.005	---	---	0.0016	0.0004	0.00077	NC	0.0016	d
	PCB 114	4	4	0.00000069	0.00047	---	---	0.00016	0.000032	0.000078	NC	0.00016	d
	PCB 118	4	4	0.000027	0.036	---	---	0.012	0.0017	0.005	NC	0.012	d
	PCB 123	4	4	0.000001	0.00064	---	---	0.00022	0.00005	0.00012	NC	0.00022	d
	PCB 126	4	3	0.000016	0.00018	0.00000025	0.00000025	0.000071	0.000013	0.000052	NC	0.000071	d
	PCB 156	4	4	0.0000075	0.0032	---	---	0.0012	0.0003	0.00075	NC	0.0012	d
	PCB 157	4	4	0.0000075	0.0032	---	---	0.0012	0.0003	0.00075	NC	0.0012	d
	PCB 167	4	4	0.0000025	0.0012	---	---	0.00053	0.00014	0.00045	NC	0.00053	d
	PCB 169	4	2	0.0000031	0.000014	0.0000003	0.000004	0.0000048	0.0000019	0.0000026	NC	0.0000048	d
	PCB 189	4	4	0.00000067	0.00039	---	---	0.00016	0.000038	0.00012	NC	0.00016	d
	PCB 77	4	4	0.000001	0.0015	---	---	0.00062	0.000083	0.00049	NC	0.00062	d
	PCB 81	4	3	0.0000015	0.000034	0.00000034	0.00000034	0.000011	0.000003	0.0000057	NC	0.000011	d

**APPENDIX C, TABLE 1**  
**EXPOSURE CONCENTRATIONS FOR SURFACE WATER, SEDIMENT, AND SOIL**  
**NORTH CENTRAL DEVIL'S SWAMP AOI**  
**STEP 3 - PROBLEM FORMULATION RESPONSE TO COMMENTS**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Medium</i>	<i>Aroclor</i>	<i>No. Samples</i>	<i>No. Detects</i>	<i>Detects</i>		<i>Non-Detects</i>		<i>Summary Statistics</i>				<i>Step 3 Exposure Concentration</i>	<i>Notes</i>
				<i>Min</i>	<i>Max</i>	<i>Min LOD</i>	<i>Max LOD</i>	<i>Mean</i>	<i>GeoMean</i>	<i>Median</i>	<i>95% UCL</i>		
Soil (mg/kg)	PCB 105	2	2	0.000013	0.00034	---	---	0.00018	0.000066	0.00018	NC	0.00018	d
	PCB 114	2	2	0.00000069	0.000025	---	---	0.000013	0.0000042	0.00001	NC	0.000013	d
	PCB 118	2	2	0.000027	0.001	---	---	0.00051	0.00016	0.00051	NC	0.00051	d
	PCB 123	2	2	0.00000099	0.000051	---	---	0.000026	0.0000071	0.00003	NC	0.000026	d
	PCB 126	2	1	0.000016	0.000016	0.00000025	0.00000025	0.0000081	0.0000014	0.00001	NC	0.0000081	d
	PCB 156	2	2	0.0000075	0.0003	---	---	0.00015	0.000047	0.00015	NC	0.00015	d
	PCB 157	2	2	0.0000075	0.0003	---	---	0.00015	0.000047	0.00015	NC	0.00015	d
	PCB 167	2	2	0.0000025	0.00017	---	---	0.000086	0.000021	0.00009	NC	0.000086	d
	PCB 169	2	1	0.0000031	0.0000031	0.0000003	0.0000003	0.0000016	0.00000068	0.00000	NC	0.0000016	d
	PCB 189	2	2	0.00000067	0.000042	---	---	0.000021	0.0000053	0.000021	NC	0.000021	d
	PCB 77	2	2	0.000001	0.000033	---	---	0.000017	0.0000057	0.000017	NC	0.000017	d
	PCB 81	2	1	0.0000015	0.0000015	0.00000034	0.00000034	0.0000008	0.0000005	0.0000008	NC	0.00000084	d

## Notes:

LOD - Limit of Detection

NC - 95% UCL not calculated due to insufficient number of samples

UCL - Upper confidence limit

mg/L - milligrams per liter

mg/kg - milligrams per kilogram

a - Not detected. Exposure assumed to be negligible

b - Mid-point of lowest LOD/2 and highest LOD/2

d - 95% UCL calculated by ProUCL

d- Arithmetic mean with non-detects set to LOD/2

**APPENDIX C, TABLE 2**  
**EXPOSURE CONCENTRATIONS FOR SURFACE WATER, SEDIMENT, AND SOIL**  
**DRAINAGE DITCH AOI**  
**STEP 3 - PROBLEM FORMULATION RESPONSE TO COMMENTS**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Medium	Aroclor	No. Samples	No. Detects	Detects		Non-Detects		Summary Statistics				Step 3 Exposure Concentration	Notes
				Min	Max	Min LOD	Max LOD	Mean	GeoMean	Median	95% UCL		
Surface Water (mg/L)	Aroclor-1016	12	0	---	---	0.000012	0.000013	---	---	---	---	0	a
	Aroclor-1221	12	0	---	---	0.000012	0.000012	---	---	---	---	0	a
	Aroclor-1232	12	0	---	---	0.000014	0.000015	---	---	---	---	0	a
	Aroclor-1242	12	0	---	---	0.0000088	0.0000093	---	---	---	---	0	a
	Aroclor-1248	12	0	---	---	0.000011	0.000011	---	---	---	---	0	a
	Aroclor-1254	12	10	---	---	0.000011	0.000011	0.000089	0.000059	0.000097	0.00016	0.00016	b
	Aroclor-1260	12	1	0.00033	0.000033	0.0000064	0.0000068	---	---	---	NC	0.0000068	c
Sediment (mg/kg)	Aroclor-1016	12	0	---	---	0.00078	0.0087	---	---	---	---	0.0024	d
	Aroclor-1221	12	0	---	---	0.001	0.011	---	---	---	---	0.003	d
	Aroclor-1232	12	0	---	---	0.0009	0.01	---	---	---	---	0.0027	d
	Aroclor-1242	12	0	---	---	0.00085	0.0095	---	---	---	---	0.0026	d
	Aroclor-1248	12	0	---	---	0.00049	0.0055	---	---	---	---	0.0015	d
	Aroclor-1254	12	12	0.0081	1.7	---	---	0.54	0.22	0.39	0.82	0.82	b
	Aroclor-1260	12	5	0.18	0.69	0.00074	0.0083	0.17	0.0082	0.0023	0.45	0.45	b
Soil (mg/kg)	Aroclor-1016	7	0	---	---	0.00078	0.0044	---	---	---	---	0.0013	d
	Aroclor-1221	7	0	---	---	0.001	0.0056	---	---	---	---	0.0017	d
	Aroclor-1232	7	0	---	---	0.0009	0.005	---	---	---	---	0.0015	d
	Aroclor-1242	7	0	---	---	0.00085	0.0048	---	---	---	---	0.0014	d
	Aroclor-1248	7	0	---	---	0.00049	0.0028	---	---	---	---	0.00082	d
	Aroclor-1254	7	7	0.0081	1.3	---	---	0.32	0.094	0.10	1.26	1.26	b
	Aroclor-1260	7	3	0.18	0.69	0.00074	0.00082	0.16	0.007	0.00041	0.38	0.38	b
Sediment (mg/kg)	PCB 105	3	3	0.0016	0.031	---	---	0.0209	0.011	0.03	NC	0.021 <sup>b</sup>	e
	PCB 114	3	3	0.000036	0.0018	---	---	0.0012	0.00048	0.0017	NC	0.0012 <sup>b</sup>	e
	PCB 118	3	3	0.0035	0.13	---	---	0.085	0.038	0.12	NC	0.085 <sup>b</sup>	e
	PCB 123	3	3	0.00008	0.0016	---	---	0.001	0.00056	0.0014	NC	0.001	e
	PCB 126	3	3	0.0000074	0.00061	---	---	0.00026	0.000092	0.00017	NC	0.00026 <sup>b</sup>	e
	PCB 156	3	3	0.00057	0.013	---	---	0.0089	0.0046	0.013	NC	0.0089 <sup>b</sup>	e
	PCB 157	3	3	0.00057	0.013	---	---	0.0089	0.0046	0.013	NC	0.0089 <sup>b</sup>	e
	PCB 167	3	3	0.00019	0.0038	---	---	0.0025	0.0014	0.0036	NC	0.0025 <sup>b</sup>	e
	PCB 169	3	0	---	---	0.0000052	0.000033	---	---	---	NC	0.00001	e
	PCB 189	3	3	0.00005	0.00052	---	---	0.0003	0.0002	0.00032	NC	0.0003 <sup>b</sup>	e
	PCB 77	3	3	0.000075	0.0021	---	---	0.0013	0.00063	0.0016	NC	0.0013 <sup>b</sup>	e
	PCB 81	3	1	0.00002	0.00002	0.0000045	0.00003	---	---	---	NC	0.00002 <sup>c</sup>	f

**APPENDIX C, TABLE 2**  
**EXPOSURE CONCENTRATIONS FOR SURFACE WATER, SEDIMENT, AND SOIL**  
**DRAINAGE DITCH AOI**  
**STEP 3 - PROBLEM FORMULATION RESPONSE TO COMMENTS**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Medium</i>	<i>Aroclor</i>	<i>No. Samples</i>	<i>No. Detects</i>	<i>Detects</i>		<i>Non-Detects</i>		<i>Summary Statistics</i>				<i>Step 3 Exposure Concentration</i>	<i>Notes</i>
				<i>Min</i>	<i>Max</i>	<i>Min LOD</i>	<i>Max LOD</i>	<i>Mean</i>	<i>GeoMean</i>	<i>Median</i>	<i>95% UCL</i>		
Soil (mg/kg)	PCB 105	1	1	0.0016	0.0016	---	---	---	---	---	NC	0.0016	f
	PCB 114	1	1	0.000036	0.000036	---	---	---	---	---	NC	0.000036	f
	PCB 118	1	1	0.0035	0.0035	---	---	---	---	---	NC	0.0035	f
	PCB 123	1	1	0.00008	0.00008	---	---	---	---	---	NC	0.00008	f
	PCB 126	1	1	0.0000074	0.0000074	---	---	---	---	---	NC	0.0000074	f
	PCB 156	1	1	0.00057	0.00057	---	---	---	---	---	NC	0.00057	f
	PCB 157	1	1	0.00057	0.00057	---	---	---	---	---	NC	0.00057	f
	PCB 167	1	1	0.00019	0.00019	---	---	---	---	---	NC	0.00019	f
	PCB 169	1	0	---	---	0.0000052	0.0000052					0.0000026	f
	PCB 189	1	1	0.00005	0.00005	---	---	---	---	---	NC	0.00005	f
	PCB 77	1	1	0.000075	0.000075	---	---	---	---	---	NC	0.000075	f
	PCB 81	1	0	---	---	0.0000045	0.0000045	---	---	---	---	0.0000023	f

## Notes:

LOD - Limit of Detection

NC - 95% UCL not calculated due to insufficient number of samples

UCL - Upper confidence limit

mg/L - milligrams per liter

mg/kg - milligrams per kilogram

a - Not detected. Exposure assumed to be negligible

b - 95% UCL calculated by ProUCL

c - Highest LOD

d - Mid-point of lowest LOD/2 and highest LOD/2

e - Arithmetic mean; median concentration approximates the maximum concentration

f - Single detected concentration

**APPENDIX C, TABLE 3**  
**EXPOSURE CONCENTRATIONS FOR SURFACE WATER, SEDIMENT, AND SOIL**  
**NORTH DEVIL'S SWAMP AOI**  
**STEP 3 - PROBLEM FORMULATION RESPONSE TO COMMENTS**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Medium	Aroclor	No. Samples	No. Detects	Detects		Non-Detects		Summary Statistics				Step 3 Exposure Concentration	Notes
				Min	Max	Min LOD	Max LOD	Mean	GeoMean	Median	95% UCL		
Surface Water (mg/L)	Aroclor-1016	15	1	0.000022	0.000022	0.000012	0.000012	---	---	---	NC	0.00012	a,b
	Aroclor-1221	15	0	---	---	0.000012	0.000012	---	---	---	---	0	c
	Aroclor-1232	15	0	---	---	0.000014	0.000014	---	---	---	---	0	c
	Aroclor-1242	15	0	---	---	0.0000088	0.0000088	---	---	---	---	0	c
	Aroclor-1248	15	0	---	---	0.000011	0.000011	---	---	---	---	0	c
	Aroclor-1254	15	0	---	---	0.000011	0.000011	---	---	---	---	0	c
	Aroclor-1260	15	0	---	---	0.000064	0.000065	---	---	---	---	0	c
Sediment (mg/kg)	Aroclor-1016	15	0	---	---	0.00094	0.011	---	---	---	---	0.003	d
	Aroclor-1221	15	0	---	---	0.0012	0.014	---	---	---	---	0.0038	d
	Aroclor-1232	15	0	---	---	0.0011	0.013	---	---	---	---	0.0035	d
	Aroclor-1242	15	3	0.061	0.67	0.001	0.012	0.055	0.003	0.00001	0.19	0.19	e
	Aroclor-1248	15	0	---	---	0.00060	0.007	---	---	---	---	0.0019	d
	Aroclor-1254	15	15	0.073	5.2	---	---	0.77	0.33	0.0000081	1.60	1.60	e
	Aroclor-1260	15	6	0.04	0.28	0.0009	0.011	0.054	0.0064	0.0000073	0.13	0.13	e
Sediment (mg/kg)	PCB 105	4	4	0.0019	0.034	---	---	0.013	0.0077	0.0083	NC	0.013	f
	PCB 114	4	4	0.00014	0.0022	---	---	0.00079	0.00047	0.00042	NC	0.00079	f
	PCB 118	4	4	0.014	0.10	---	---	0.046	0.035	0.034	NC	0.046	f
	PCB 123	4	4	0.00015	0.0019	---	---	0.00076	0.00049	0.00049	NC	0.00076	f
	PCB 126	4	4	0.000045	0.00021	---	---	0.000096	0.000079	0.000064	NC	0.000096	f
	PCB 156	4	4	0.0012	0.012	---	---	0.005	0.0035	0.0034	NC	0.005	f
	PCB 157	4	4	0.0012	0.012	---	---	0.005	0.0035	0.0034	NC	0.005	f
	PCB 167	4	4	0.00044	0.0032	---	---	0.0014	0.0011	0.001	NC	0.0014	f
	PCB 169	4	0	---	---	0.0000032	0.000039	---	---	---	NC	---	d
	PCB 189	4	4	0.0001	0.00039	---	---	0.00021	0.00018	0.00018	NC	0.00021	f
	PCB 77	4	4	0.00048	0.0016	---	---	0.00086	0.00076	0.00068	NC	0.00086	f
	PCB 81	4	3	0.00001	0.000069	---	---	0.000024	0.000013	0.000013	NC	0.000024	f

## Notes:

LOD - Limit of Detection

NC - 95% UCL not calculated due to insufficient number of samples

UCL - Upper confidence limit

mg/L - milligrams per liter

mg/kg - milligrams per kilogram

a - Highest LOD

b - Value of 0.000014 mg/L in Table 3.9 of Problem Formulation Document is a typo

c - Not detected. Exposure assumed to be negligible

d - Mid-point of lowest LOD/2 and highest LOD/2

e - 95% UCL calculated by ProUCL

f - Arithmetic mean with non-detects set to LOD/2

**APPENDIX C, TABLE 4**  
**EXPOSURE CONCENTRATIONS FOR SURFACE WATER, SEDIMENT, AND SOIL**  
**SOUTH DEVIL'S SWAMP AOI**  
**STEP 3 - PROBLEM FORMULATION RESPONSE TO COMMENTS**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

Medium	Aroclor	No. Samples	No. Detects	Detects		Non-Detects		Summary Statistics				Step 3 Exposure Concentration	Notes
				Min	Max	Min LOD	Max LOD	Mean	GeoMean	Median	95% UCL		
Surface Water (mg/L)	Aroclor-1016	10	0	---	---	0.000012	0.000013	---	---	---	---	0	a
	Aroclor-1221	10	0	---	---	0.000012	0.000012	---	---	---	---	0	a
	Aroclor-1232	10	0	---	---	0.000014	0.000015	---	---	---	---	0	a
	Aroclor-1242	10	0	---	---	0.0000088	0.0000093	---	---	---	---	0	a
	Aroclor-1248	10	0	---	---	0.000011	0.000011	---	---	---	---	0	a
	Aroclor-1254	10	0	---	---	0.000011	0.000011	---	---	---	---	0	a
	Aroclor-1260	10	0	---	---	0.0000064	0.0000068	---	---	---	---	0	a
Sediment (mg/kg)	Aroclor-1016	10	0	---	---	0.00083	0.0023	---	---	---	---	0.00078	b
	Aroclor-1221	10	0	---	---	0.0011	0.003	---	---	---	---	0.001	b
	Aroclor-1232	10	0	---	---	0.00095	0.0027	---	---	---	---	0.00091	b
	Aroclor-1242	10	1	0.033	0.033	0.0009	0.0026	---	---	---	---	0.0356	c
	Aroclor-1248	10	0	---	---	0.00052	0.0015	---	---	---	---	0.00051	b
	Aroclor-1254	10	10	0.0043	0.28	---	---	0.093	0.062	0.0715	0.17	0.17	d
	Aroclor-1260	10	5	0.0016	0.08	0.0011	0.0022	0.017	0.0039	0.0014	0.042	0.042	d
Sediment (mg/kg)	PCB 105	3	3	0.0017	0.0038	---	---	0.0026	0.0025	0.0024	NC	0.0026	e
	PCB 114	3	3	0.00013	0.00022	---	---	0.00017	0.00017	0.00017	NC	0.00017	e
	PCB 118	3	3	0.013	0.017	---	---	0.015	0.015	0.016	NC	0.015	e
	PCB 123	3	3	0.00012	0.00024	---	---	0.00019	0.00018	0.0002	NC	0.00019	e
	PCB 126	3	3	0.000028	0.00011	---	---	0.000071	0.000061	0.000074	NC	0.000071	e
	PCB 156	3	3	0.00099	0.0019	---	---	0.0014	0.0013	0.0013	NC	0.0014	e
	PCB 157	3	3	0.00099	0.0019	---	---	0.0014	0.0013	0.0013	NC	0.0014	e
	PCB 167	3	3	0.00037	0.00061	---	---	0.00047	0.00046	0.00044	NC	0.00047	e
	PCB 169	2	0	---	---	0.0000033	0.0000098	---	---	---	NC	0.0033	b
	PCB 189	3	3	0.00005	0.00009	---	---	0.000068	0.000066	0.000064	NC	0.000068	e
	PCB 77	3	3	0.00038	0.00058	---	---	0.00045	0.00044	0.00039	NC	0.00045	e
	PCB 81	2	2	0.0000068	0.000023	---	---	0.000015	0.000013	0.000015	NC	0.000015	e

## Notes:

LOD - Limit of Detection

NC - 95% UCL not calculated due to insufficient number of samples

UCL - Upper confidence limit

mg/L - milligrams per liter

mg/kg - milligrams per kilogram

a - Not detected. Exposure assumed to be negligible

b - Mid-point of lowest LOD/2 and highest LOD/2

c - Mid-point between the single detected concentration and highest Limit of Detection

d - 95% UCL calculated by ProUCL

e- Arithmetic mean with non-detects set to LOD/2

**APPENDIX C, TABLE 5**  
**EXPOSURE CONCENTRATIONS FOR SOIL**  
**COMBINED DATA FOR NORTH CENTRAL DEVIL'S SWAMP AND DRAINAGE DITCH AOIs**  
**STEP 3 - PROBLEM FORMULATION RESPONSE TO COMMENTS**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

<i>Medium</i>	<i>Aroclor</i>	<i>No. Samples</i>	<i>No. Detects</i>	<i>Detects</i>		<i>Non-Detects</i>		<i>Summary Statistics</i>				<i>Step 3 Exposure Concentration</i>	<i>Notes</i>
				<i>Min</i>	<i>Max</i>	<i>Min LOD</i>	<i>Max LOD</i>	<i>Mean</i>	<i>GeoMean</i>	<i>Median</i>	<i>95% UCL</i>		
Soil (mg/kg)	Aroclor-1016	16	0	---	---	0.00077	0.0044	---	---	---	---	0.0013	a
	Aroclor-1221	16	0	---	---	0.001	0.0056	---	---	---	---	0.0016	a
	Aroclor-1232	16	0	---	---	0.00089	0.005	---	---	---	---	0.0015	a
	Aroclor-1242	16	2	0.0061	0.0067	0.00085	0.0048	0.0013	0.00073	0.00048	0.0062	0.0062	b
	Aroclor-1248	16	0	---	---	0.00049	0.0028	---	---	---	---	0.00082	a
	Aroclor-1254	16	12	0.00087	1.3	0.00074	0.00083	0.14	0.0075	0.0043	0.51	0.51	b
	Aroclor-1260	16	7	0.0063	0.69	0.00074	0.0011	0.092	0.004	0.00049	0.19	0.19	b
Soil (mg/kg)	PCB 105	3	3	0.000013	0.0016	---	---	0.00065	0.00019	0.00034	NC	0.00065	c
	PCB 114	3	3	0.0000069	0.000036	---	---	0.000021	0.0000085	0.000025	NC	0.000021	c
	PCB 118	3	3	0.000027	0.0035	---	---	0.0015	0.00046	0.001	NC	0.0015	c
	PCB 123	3	3	0.000001	0.00008	---	---	0.000044	0.000016	0.000051	NC	0.000044	c
	PCB 126	3	2	0.0000074	0.000016	0.00000025	0.00000025	0.0000078	0.0000025	0.0000074	NC	0.0000078	c
	PCB 156	3	3	0.0000075	0.00057	---	---	0.00029	0.00011	0.0003	NC	0.00029	c
	PCB 157	3	3	0.0000075	0.00057	---	---	0.00029	0.00011	0.0003	NC	0.00029	c
	PCB 167	3	3	0.0000025	0.00019	---	---	0.00012	0.000043	0.00017	NC	0.00012	c
	PCB 169	3	1	0.0000031	0.0000031	0.0000003	0.0000052	---	---	---	NC	0.0000031	d
	PCB 189	3	3	0.0000067	0.00005	---	---	0.000031	0.000011	0.000042	NC	0.000031	c
	PCB 77	3	3	0.000001	0.000075	---	---	0.000036	0.000014	0.000033	NC	0.000036	c
	PCB 81	3	1	0.0000015	0.0000015	0.00000034	0.0000045	---	---	---	NC	0.0000015	d

## Notes:

LOD - Limit of Detection

NC - 95% UCL not calculated due to insufficient number of samples

UCL - Upper confidence limit

mg/kg - milligrams per kilogram

a - Mid-point of lowest LOD/2 and highest LOD/2

b - 95% UCL calculated by ProUCL

c - Arithmetic mean with non-detects set to LOD/2

d - Single detected concentration

## APPENDIX D

### CALCULATION OF INGESTION RATES FOR AVIAN AND MAMMALIAN RECEPTORS



**APPENDIX D, TABLE 1**  
**CALCULATION OF INGESTION RATES FOR AVIAN RECEPTORS**  
**STEP 3 - PROBLEM FORMULATION RESPONSE TO COMMENTS**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

**Allometric Equation from Nagy (1987)**

$$\text{ALL BIRDS } I_{\text{Food}} (\text{grams/day}) = 0.648 \times \text{Weight (grams)}^{0.651}$$

Step	Description	Source	Units	Green Heron <sup>a</sup>	Belted Kingfisher <sup>b</sup>	Bald Eagle	American Woodcock	Northern Bobwhite	Red-Tailed Hawk
1	Body Mass of Receptor	USEPA 1999	grams	230	150	3,750	180	190	1,130
2	Allometric Equation	Nagy 1987	grams/day DW	All Birds	All Birds	All Birds	All Birds	All Birds	All Birds
3	Calculate $IR_{\text{Food}}$	---	grams/day DW	22.34	16.91	137.49	19.04	19.73	62.97
4	Convert g/day to kg/day	---	kg/day DW	0.0223	0.0169	0.1375	0.0190	0.0197	0.0630
5	Normalize ingestion to body mass	---	kg DW/kg Body Wt - day	0.0971	0.1128	0.0367	0.1058	0.1038	0.0557
6	Obtain % incidental ingestion	USEPA 1999	%	9.4	5.9	5.9	10.4	9.3	1.0
7	Calculate $IR_{\text{SED}}$	---	kg DW/kg Body Wt - day	0.0091	0.0067	0.0022	0.0110	0.010	0.0006
8	Calculate $IR_{\text{Food}}^{\text{WW}}$	---	kg WW/kg Body Wt - day	<b>0.5112</b>	<b>0.3523</b>	0.1146	0.5568	0.8652	0.1741
			Adjustment for Moisture Content of Food (Trophic Level)	0.19 (Insect)	0.32 (Pisc)	0.32 (Pisc)	0.19 (Insect)	0.12 (Herb)	0.32 (Carn)
9	Obtain $IR_{\text{Water}}$	USEPA 1999	L/day	0.022	0.016	0.14	0.019	0.019	0.064
10	Normalize $IR_{\text{Water}}$ to body mass	---	L/kg-day	0.0957	0.107	0.037	0.106	0.100	0.057

Notes:

Bold Font identifies revision to values in Table 3-1<sup>5</sup>

DW - Dry Weight

WW - Wet Weight

Wt - Weight

a - In Step 8,  $IR_{\text{Food}}$  for Green Heron was inadvertently adjusted for water content by dividing by 0.12 for herbivores rather than 0.19 for insectivores. This error overestimated  $I_{\text{Food}}$ .

b - In Step 2,  $IR_{\text{Food}}$  was incorrectly entered as 0.56 rather than the correct value of 0.3523. The correct value was used in the food chain models for Belted Kingfisher.

Insect - Insectivore

Pisc - Piscivore

Herb - Herbivore

Carn - Carnivore

**APPENDIX D, TABLE 2**  
**CALCULATION OF INGESTION RATES FOR MAMMALIAN RECEPTORS**  
**STEP 3 - PROBLEM FORMULATION RESPONSE TO COMMENTS**  
**DEVIL'S SWAMP LAKE SITE**  
**EAST BATON ROUGE PARISH, LOUISIANA**

**Allometric Equations from Nagy (1987)**

**ALL MAMMALS**  $IR_{Food} \text{ (grams/day)} = 0.235 \times \text{Weight (grams)}^{0.822}$

**HERBIVORES**  $IR_{Food} \text{ (grams/day)} = 0.577 \times \text{Weight (grams)}^{0.727}$

<i>Step</i>	<i>Description</i>	<i>Source</i>	<i>Units</i>	<i>Brown Bat <sup>a</sup></i>	<i>Muskrat</i>	<i>Mink</i>	<i>Short-Tailed Shrew</i>	<i>Deer Mouse</i>	<i>Red Fox</i>
1	Body Mass of Receptor	USEPA 1999	grams	<b>10</b>	870	990	20	20	4,530
2	Allometric Equation	Nagy 1987	grams/day DW	Mammal	Herb	Mammal	Mammal	Herb	Mammal
3	Calculate $IR_{Food}$	---	grams/day DW	<b>1.56</b>	79.11	68.15	2.76	5.09	237.9
4	Convert g/day to kg/day	---	kg/day DW	<b>0.0016</b>	0.079	0.068	0.003	0.005	0.238
5	Normalize ingestion to body mass	---	kg DW/kg Body Wt - day	<b>0.156</b>	0.091	0.069	0.138	0.255	0.053
6	Obtain % incidental ingestion	USEPA 1999	%	<b>0</b>	3.3	9.4	1.0	2.0	2.8
7	Calculate $IR_{SED}$	---	kg DW/kg Body Wt - day	<b>0</b>	0.003	0.006	0.0014	0.0051	0.001
8	Calculate $IR_{Food}^{WW}$	---	kg WW/kg Body Wt - day	0.821	0.758	0.215	0.726	2.12	0.164
			Adjustment for Moisture Content of Food (Trophic Level)	0.19 (Insect)	0.12 (Herb)	0.32 (Pisc)	0.19 (Insect)	0.12 (Herb)	0.32 (Carn)
9	Obtain $IR_{Water}$	USEPA 1999	kg/day	0.0014	0.088	0.098	0.0035	0.0029	0.39
10	Normalize $IR_{Water}$ to body mass	---	kg/kg-day	0.140	0.101	0.099	0.175	0.145	0.086

Notes:

Bold Font identifies revision to values in Table 3-16

DW - Dry Weight

WW - Wet Weight

Wt - Weight

a - For Brown Bat, values for Steps 1, 3, 4, 5, 6, and 7 were incorrectly entered in Table 3.16. The correct values were used in the food chain models for Brown Ba

Insect - Insectivore

Pisc - Piscivore

Herb - Herbivore

Carn - Carnivore